

The Tertiary Mollusca of the Chatham Islands including a Generic Revision of the New Zealand Pectinidae.

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NOTE BY H. J. FINLAY, D.Sc.

Owing to unforeseen delay in publication of my account of the Chatham Island Recent Mollusca and the usage by Dr. Marwick in the following paper of some of the new names there given, it is necessary in order to avoid priority confusion to make the following formal propositions:

Ellicea n. gen. for *Siphonalia orbita* Hutton.

Notostrea n. gen. for *Ostrea subdentata* Hutton.

Notostrea lubra n. sp. for *Gryphaea tarda* Tate, not Hutton.

Scalpomactra n. gen. for *Macra scalpellum* Reeve.

1. INTRODUCTION.

THE first list of specifically identified fossils from the Chatham Islands was that published by Hutton in his Catalogue of Tertiary Mollusca 1873. Thirteen species were recognised, all except "*Gryphaea*" *tarda* represented in New Zealand, and three occurring in the recent fauna. No exact locality had been supplied with the specimens, and as the assemblage did not closely correspond to that of any New Zealand horizon, Hutton thought that more than one formation had been collected from. He says (1873, p. viii.): "The fossils from the Chatham Islands appear to be mixed, as shells characteristic of the Kanieri group, the Ahuriri formation, and the Trelissick group are all in the collection. I think it probable that two formations occur there, one belonging to the Pareora formation, and the other intermediate between the Ahuriri and Oamaru forma-

tions. If, however, there should be only one formation present, I should be inclined to refer it to the Ahuriri period."

Many of Hutton's specimens have been lost and the exact locality of their origin was never stated, but all except "*Gryphaea*" *tarda* probably came from Pitt Island, and formed part of Geological Survey locality collection 792 (H. H. Travers).

A critical examination of the fossils available shows that nearly all of Hutton's records of species common to Chatham Islands and New Zealand are based on wrong identifications.

Many years later, Hutton (1902) described a single fossil, *Pecten dendyi*, given him by Professor A. Dendy, of Christchurch, and probably collected at Momoe-a-toa where the species is abundant.

During the 1924 expedition, the chief collections of Mollusca were made at four main spots on Chatham Island, and Mr. R. S. Allan was able to make another at Flower-pot Harbour, Pitt Island. In the following year he obtained additional material from these places, and also discovered a new and richly fossiliferous locality on Whenuataru Peninsula, Pitt Island.

2. DESCRIPTION OF FOSSILIFEROUS LOCALITIES.

(1.) Momoe-a-toa.

The most northerly point of Chatham Island is Cape Young, one mile to the south-west of which projects Momoe-a-toa. The fossils occur in a tufaceous limestone between two lava-flows, on the northern side and well out towards the point.

(2.) Tioriori.

The fossiliferous locality is about four miles south along the coast from Momoe-a-toa, and about half a mile north-east of Tioriori and Tutuiri Creek. The fossiliferous bed is a soft bryozoan limestone with occasional quartz pebbles, and is exposed in the sea cliffs which are about 50 feet high. The limestone rests disconformably on green unfossiliferous tuffs.

(3.) Titirangi.

Titirangi is a bluff about 75 feet high, half way along the southern shore of the north-western extension of Te Whanga Lagoon known as Muriwhenua. The bluff can be seen from afar, for it is crowned by a karaka grove. The fossils are found on the northern or lake side.

(4.) Waikaripi.

The Wireless Station stands on high country about one mile south-west of Waitangi, and in the sea cliffs south-west, below the Wireless Station, are two bands of fossiliferous, tuffaceous limestone separated by unfossiliferous, calcareous tuffs.

(5.) Flower-pot Harbour, Pitt Island.

This locality is on the northern bay of Pitt Island. The fossiliferous tuffs occur at Onoua, on the eastern side of the harbour, and unconformably overlie a bryozoan limestone.

(6.) Whenuataru Peninsula, Pitt Island.

Whenuataru Peninsula forms the north-west corner of Pitt Island, and is about one mile west of the Flower-pot. The richly

fossiliferous tuffs outcrop on the south side of the Peninsula, and, as at the Flower-pot, unconformably overlies a bryozoan limestone.

The fossils at all of these localities except No. 3, Titirangi, are associated with a relatively extensive group of limestones and tuffs which Mr. Allan has named the Wharekauri-Waitangi Series. These rocks cover a considerable part of the islands and are of mid-Tertiary age. At Titirangi the fossiliferous beds are unconsolidated shell sands of restricted occurrence and obviously belong to the late Tertiary.

3. FAUNA OF THE WHAREKAURI-WAITANGI SERIES.

a. General Discussion.

Perhaps the most striking feature of the fossils from the limestones and tuffs is the individuality shown by the faunules of each of the localities except the Pitt Island ones. The species collected from more than one locality are tabulated below.

	Momoe-a-toa	Tioriori	Waitangi	Waikaripi	Flower-pot	Whenuataru
<i>Glycymeris traversi</i>	...	...	..	...	x	x
<i>Glycymeris hunti</i>	?	...	..	...	x	x
<i>Placopecten hectori</i>	...	...	..	...	x	...
<i>Chlamys chathamensis</i>	x	...	...	...	x	...
<i>Chlamys seymouri</i>	x	...	...	...	x	?
<i>Limatula morioria</i>	x	..	..	...	x	x
<i>Limea chathamensis</i>	x	...	...	..	...	x
<i>Notostrea tarda</i>	..	x	...	x	...	...
<i>Cardita northcrofti</i>	..	...	..	...	x	x
<i>Venericardia beata</i>	..	...	...	...	x	x
<i>Chama pittensis</i>	...	...	..	...	x	x
<i>Tawera marshalli</i>	...	...	...	...	x	x
<i>Nemocardium diversum</i>	...	...	...	x	...	?
<i>Corbula howesi</i>	...	...	...	...	x	x
<i>Turritella solomoni</i>	...	...	...	...	x	x
<i>Cochlis pittensis</i>	...	...	...	...	x	x
<i>Austrosipho asper</i>	..	...	...	...	x	x
<i>Waihaia renwicki</i>	...	...	...	...	x	x
<i>Phenatoma decessor</i>	...	...	...	...	x	x

At Momoe-a-toa the fossils consist almost wholly of large Pectens and Brachiopods, though there are a few casts of *Glycymeris*, *Panope*, *Nuculana*, etc. At Tioriori, *Notostrea tarda* is abundant with an oyster, occasional Pectens, a *Cirsotrema* and Brachiopods, but with the exception of the *Notostrea* the species are all peculiar to this place. At Waikaripi, at the Flower-pot and at Whenuataru Peninsula there are mixed faunas; but the large Pectens of Momoe-a-toa are absent, and the Waikaripi faunule is very different from the Pitt Island ones which have a strong resemblance to each other in their commonest shells.

The fossiliferous beds can be divided into two groups,—

A. Upper (Calcareous Tuffs)	{	Momoe-a-toa
		Flower-pot
		Whenuataru
B. Lower (Bryozoan Limestone)	{	Tioriori
		Waitangi
		Waikaripi
		Flower-pot

The absence of identical or related species at most of the localities is perhaps due more to difference of station than to difference of age. However the matrix of the Flower-pot fossils resembles that of the Waikaripi ones and both places have the genera *Nemocardium*, *Venericardia*, *Corbula*, and *Chlamys* so that the environment was probably similar. The lack of specific agreement therefore is a fair indication of difference in age. Further, a number of the Mollusca from Whenuataru and the Flower-pot have strong Wanganuian affinities, e.g., *Thyasira flexuosa*, *Venericardia beata*, *Cardita northcrofti*, *Corbula howesi*, *Merelina avita*, *Phenatoma decessor*. It is therefore possible that a considerable time-interval separates the calcareous tuffs from the bryozoan limestone; but for the present it seems best to consider all as belonging to one period.

Seventy-nine species of Mollusca have been recognised from the marine tuffs and limestones; and of these only two (2.5%) are Recent. Both identifications of the Recent species are founded on poor material, so it is likely that they too can be separated as new when more specimens are collected.

Much has been written about the Lyellian method of reckoning position in the Tertiary sequence by means of the percentage of contained Recent Mollusca; but the work done on this subject by modern American palaeontologists has not received sufficient attention in New Zealand. Using only those localities with 50 species or over Dall (1903, p. 1617) got for the Eastern American Oligocene from 2 to 12% Recent, and for the Miocene 13 to 20%. (The upper part of Dall's Oligocene is now classed in the Miocene).

Martin and Glen's work on the Miocene of Maryland (Clark, Shattuck and Dall, 1904, p. cxlix) gave only 10% of Recent Mollusca.

The San Pablo group of Middle California supplied 23.5% Recent forms to Bruce Clark (1915, p. 424) who placed the beds as Upper Miocene or possible Lower Pliocene.

In a recent paper on the comparative value of various organisms in zoning, Vaughan (1923, p. 519) says, "The percentage of Recent Mollusks in the Lower Miocene ranges between 3 and 7.5 per cent."; he also gives a table showing eleven Miocene localities with percentages ranging from 3 (Lower Miocene) to 27 (Upper Miocene), and two Oligocene localities where there are no Recent species.

The very low percentage of Recent forms in the Chatham Island fauna (2%, perhaps 0%) shows that it belongs to early or middle Tertiary times, and the generic assemblage favours classifications as Upper Oligocene or Lower Miocene.

Of the eighty species only four occur in New Zealand. They are: *Thyasira flexuosa*, *Tawera marshalli*, *Rissoina chathamensis*, and *Cochlis notocenica*. None of these species is represented by well-preserved specimens, so that the identifications are not above suspicion. Most of the genera have been common in New Zealand since the Waiarekan, and some of the species have close relatives in our middle and later Tertiary strata.

The occurrence of the genus *Perotrochus* one of the Pleurotomariidae is interesting. A fine new species was found by Mr. Allan in the cliffs at Waikaripi, below the Wireless Station. Though always exceedingly rare in the Tertiary, the family has remarkably wide distribution, and there are four Recent species. *P. tertiaria* McCoy has been found at only one locality in Australia in Lower Tertiary Beds, and the specimens from the Wharekuri greensand, Waitaki Valley, were classed by Hutton (on rather poor grounds) under the same species. The exact age of these Wharekuri beds remains to be demonstrated, but it is probably Ototaran or Hutchinsonian; that is, somewhere about the Oligocene.

A large *Perotrochus*, perhaps the same species as that at Wharekuri, is fairly common in the Hutchinsonian greensands at Allday Bay, Kakanui; but the specimens are difficult to collect. The Chatham Island shell, though belonging to the same imperforate genus, *Perotrochus*, is quite distinct specifically, so that no correlation can be made by means of it.

Another noteworthy shell is "*Gryphaea*" *tarda* Hutton. Specimens from the Balcombian and Janjukian of Southern Australia were identified by Tate (1886, p. 98) as the same species; and Ortmann (1902, p. 113) compared with *G. tarda*, a shell supposed to be from the Patagonian beds. Recently, Finlay has shown that the Australian shells are specifically distinct from the Chatham Island ones and has named them *Notostrea lubra*. Ihering (1907, pp. 6, 245) cast a certain amount of doubt on the Tertiary occurrence of Ortmann's specimen and identified it as the Upper Cretaceous *G. burckhardti* Boehm.

The writer agrees with Finlay (in ms.) that *G. tarda* is related to the genus *Notostrea* Finlay, and thinks it probable that the Australian and South American species have arisen independently from *Ostrea*. Trueman (1922, p. 264) has already shown such to have happened with Jurassic "*Gryphaea*."

b. Faunal Lists of Wharekauri-Waitangi Series.

(Recent species marked *)

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|--|---|
| (1) Momoe-a-toa, Chatham Island. | <i>Limea chathamensis</i> n. sp. |
| <i>Glycymeris hunti</i> n. sp. | <i>Ostrea arcuata</i> n. sp. |
| <i>Monia furcilla</i> n. sp. | <i>Cirsotrema chathamense</i> n. sp. |
| <i>Sectipecten allani</i> n. sp. | <i>Cirsotrema parvulum</i> n. sp. |
| <i>Sectipecten toaensis</i> n. sp. | (2) Tioriori, Chatham Island. |
| <i>Chlamys chathamensis</i> (Hutton) | <i>Serripecten tiorioriensis</i> n. sp. |
| <i>Chlamys seymouri</i> n. sp. | <i>Lentipecten imperfectus</i> n. sp. |
| <i>Pallium</i> (? <i>Felipes</i>) <i>dendyi</i> | <i>Ostrea cannoni</i> n. sp. |
| (Hutton) | <i>Notostrea tarda</i> (Hutton) |
| <i>Limatula morioria</i> n. sp. | <i>Cirsotrema</i> (<i>Tioria</i>) <i>youngi</i> |
| | n. sp. |

- (3.) Waikaripi, near Wireless Station, Chatham Island.
Mytilus (Aulacomya) willetsi n. sp.
Chlamys mercuria n. sp.
Ostrea waitangiensis n. sp.
Notostrea tarda (Hutton)
Venericardia nuntia n. sp.
Ascitellina donaciformis n. sp.
Nemocardium diversum n. sp.
Corbula tophina n. sp.
Perotrochus allani n. sp.
Margarella runcinata n. sp.
- (4.) Calcareous tuffs, Flower-pot, Pitt Island.
Arca pittensis n. sp.
Barbatia (Pugilarca) barneiformis n. sp.
Lissarca fossilis n. sp.
Glycymeris traversi (Hutton)
Glycymeris hunti n. sp.
Placopecten hectori (Hutton)
Chlamys chathamensis (Hutton)
Chlamys seymouri n. sp.
Lima vasis n. sp.
Limatula morioria n. sp.
Ctenoides naufragus n. sp.
Cardita northcrofti n. sp.
Venericardia beata n. sp.
Chama pittensis n. sp.
Tawera marshalli Marwick
Corbula howesi n. sp.
Emarginula pittensis n. sp.
Tugalia aranea n. sp.
Maurea finlayi n. sp.
Imperator anthropophagus n. sp.
Argalista effusa n. sp.
Argalista arta n. sp.
Merelina avita n. sp.
Notosinister insertus n. sp.
Turritella (Spirocolpus) solomoni n. sp.
Cochlis pittensis n. sp.
Trivia flora n. sp.
Austrosipho (Verconella) asper n. sp.
Waihaia (Pachymelon) renwicki n. sp.
Marginella floralis n. sp.
Zemacies prendrevillei n. sp.
Guraleus lineatus n. sp.
- (5.) Bryozoan limestone, Flower-pot, Pitt Island.
Cirsotrema propelyratum n. sp.
- (6.) Whenuatara Peninsula, Pitt Island.
Glycymeris traversi (Hutton).
Glycymeris hunti n. sp.
Limopsis invalida n. sp.
Limatula morioria n. sp.
Limea chathamensis n. sp.
Cuna antiqua n. sp.
Cardita northcrofti n. sp.
Venericardia beata n. sp.
Chama pittensis n. sp.
**Thyasira flexuosa* (Mont.).
Leptomya concentrica n. sp.
Dosinia (Kereia) chathamensis n. sp.
Tawera marshalli Marwick.
Nemocardium diversum n. sp.
Corbula howesi n. sp.
Emarginula galeriformis n. sp.
Zeminolia lenis n. sp.
**Rissoina chathamensis* n. sp.
Turritella (Spirocolpus) solomoni n. sp.
Cochlis pittensis n. sp.
Cochlis notocenica (Finlay)
Cochlis n. sp., cf. *australis* (Hutton).
Globisium macronatum n. sp.
Korovina accelerans n. sp.
Phalium (Kahua) skinneri n. sp.
Odostomia pittensis n. sp.
Austromitra plicifera n. sp.
Austrosipho (Verconella) asper n. sp.
Ellicea (Pittella) firma n. sp.
Cominella (Eucominia) bauckei n. sp.
Zeatrophon lassus n. sp.
Waihaia (Pachymelon) renwicki n. sp.
Baryspira n. sp.
Marginella coxi n. sp.
Inquisitor acutus n. sp.
Mitrihara granum n. sp.
Phenatoma decessor n. sp.
Retusa pressa n. sp.

4. FAUNA OF THE TITIRANGI SERIES.

a. *General Discussion.*

The lower twelve feet or so of Titirangi Bluff is formed of fairly soft Bryozoan limestone, on the eroded surface of which lie the Titirangi beds. No angular unconformity can be observed between the limestone and the shell beds; both are practically horizontal.

The fossils are in a beautiful state of preservation, and can be obtained in countless numbers, the one drawback being that the variety of species is comparatively small. Thirty-eight species were obtained of which twenty-six are Pelecypods and twelve Gasteropods. This predominance of Pelecypods, their large size and strength, and the great numbers of *Amphidesma*, indicate that the containing beds were laid down in quite shallow water bordering an open beach of shell sand.

Sixteen of the thirty-eight are Recent species, that is 42%. This suggests correlation with the Waitotaran or lower stage of the Wanganui system, although the most characteristic species of that stage are not represented. The large heavy *Eumarcia* which is common in the basal four feet of the shell-bed at the western end of the outcrop appears to be conspecific with *E. plana* Marwick from the Waitotaran and the lower part of the Nukumaruan beds. Also *Paphirus largillierii* (Philippi), *Gari stangeri* (Gray), *Zemysia zelandica* (Gray), and *Glycymeris modesta* (Angas) are present in great numbers, and *Dosinia wanganuiensis* Marwick is not uncommon. The writer therefore favours correlation with the Nukumaruan, i.e., the middle stage of the Wanganui. The European equivalent of the Titirangi beds is thus about Middle Pliocene.

Specimens of a large barnacle from the Titirangi beds were submitted to Mr. T. H. Withers of the British Museum. He identified them as *Balanus* (*Megabalanus*) *tubulatus* Withers (1924, p. 28, pl. 7, figs. 1-10). This species was originally described from the Lower Pliocene of Castle Point and Waipara Gorge, New Zealand.

b. *List of Fauna from Titirangi.*

(Recent species marked *)

<i>Barbatia</i> (Acar) <i>whangaensis</i> n. sp.	<i>Neogaimardia elegantula</i> n. sp.
* <i>Glycymeris laticostata</i> (Q. and G.)	<i>Cuna firma</i> n. sp.
<i>Glycymeris waipipiensis</i> Marwick .	<i>Venericardia martini</i> n. sp., common.
* <i>Glycymeris modesta</i> (Angas), common.	<i>Condylocardia torquata</i> n. sp.
<i>Philobrya galerita</i> n. sp.	* <i>Zemysia zelandica</i> (Gray), common.
<i>Perrierina ovata</i> n. sp., com- mon.	* <i>Myllitella pinguis</i> n. sp., com- mon.
* <i>Mytilus</i> (<i>Aulacomya</i>) <i>maoria-</i> <i>nus</i> Iredale.	<i>Amphidesma</i> (<i>Taria</i>) <i>porrec-</i> <i>tum</i> n. sp., common.
<i>Chlamys titirangiensis</i> n. sp.	* <i>Mactra rudis</i> Hutton.
* <i>Limatula maoria</i> Finlay.	* <i>Scalpomactra scalpellum</i> (Reeve).
	<i>Dosinia</i> (<i>Phacosoma</i>) <i>wanga-</i> <i>nuiensis</i> Marwick.

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| * <i>Paradione</i> (<i>Notocallista</i>) <i>multistriata</i> Sowerby. | <i>Rangimata pervia</i> n. sp. |
| <i>Bassinaria macclurgii</i> n. sp. | * <i>Zethalia zelandica</i> (Adams). |
| <i>Tawera marthae</i> n. sp., common. | <i>Estea insulana</i> n. sp. |
| <i>Eumarcia plana</i> Marwick, common. | <i>Estea subtilicosta</i> n. sp. |
| * <i>Paphirus largillierti</i> (Philippi), common. | <i>Ataxocerithium simplex</i> n. sp. |
| * <i>Gari stangeri</i> (Gray), common. | * <i>Zegalerus crater</i> Finlay, common. |
| * <i>Barnea similis</i> (Gray). | <i>Cominella</i> (<i>Eucominia</i>) <i>elli-soni</i> n. sp., common. |
| <i>Atalacmea elata</i> n. sp. | <i>Zeatrophon mutabilis</i> n. sp., common. |
| * <i>Micrelenchus rufozona</i> (Adams), common. | * <i>Zemitrella choava</i> (Reeve). |
| | <i>Liracrea titirangiensis</i> n. sp. |

5. EXTERNAL RELATIONS.

The great bulk of the Molluscan fauna of the Chatham Islands, both Recent and fossil, is generically the same as that of New Zealand. The specific relationship of the Recent and Pliocene faunas of the two areas, however, is closer than that of the mid-Tertiary ones. This may be due to our not yet having discovered in New Zealand strata exactly corresponding in time and conditions of deposition to the fossiliferous tuffs of the Chathams. Most of the Oligocene and Miocene fossiliferous localities of New Zealand also, however, have marked individuality in their faunules, so that it is not common to find extensive specific identity at any two places. Of course further collecting will bring forth more material common to different localities; but apart from the time factor this lack of specific identity may have resulted from the presence in this region at that time, of groups of islands sufficiently isolated to develop well-differentiated faunal provinces.

At the present time, marine currents carry drift from New Zealand to the Chathams; but we do not know what Molluscan species can or can not avail themselves of this transportation. Therefore, while the great bulk of the genera have been derived from New Zealand, we cannot yet tell from the Molluscan evidence whether the Chatham Islands have ever been actually joined to the mainland of New Zealand.

6. ACKNOWLEDGMENTS.

In conclusion, I should like to express my sincere thanks to the residents of the Chatham Islands, not only for their kindness and hospitality to the party as a whole, but also for their invaluable help in selecting an itinerary and in locating places and formations of palaeontological importance. I am specially indebted to Dr. E. Ellison, at that time Resident Magistrate, and Mrs. Ellison, to Mr. Robert McClurg and Mrs. R. Hough of Te Roto, and to Mr. Charles Seymour of Wharekaui; also to Mr. and Mrs. C. Cannon of Maunganui, Mr. N. R. Cox of Aotea, Mr. and Mrs. J. Prendreville, and Mr. and Mrs. J. Renwick of Ouenga.

I must also thank the officers of the Otago Institute who organized the Expedition for their kindness in including me in a most profitable and enjoyable excursion, and, in addition, Mr. P. G. Morgan, Director of the New Zealand Geological Survey, and Mr. A. K. Kimbell, Under-Secretary for Mines for permitting me to take part in it.

Much of the success of the expedition was due to the enthusiasm of its leader, Mr. H. D. Skinner, anthropologist, whose cheerful and ready help was ever at our disposal. Dr. H. J. Finlay has given valuable aid in discussing and criticising the systematic classifications and nomenclature to be adopted.

Finally I would acknowledge my deep indebtedness to my field companion, Mr. R. S. Allan, geologist. In addition to his stratigraphic, petrologic, and physiographic work, he excelled as a fossil-hunter, for the bulk of the specimens described below were collected by him.

7. SYSTEMATIC CLASSIFICATION AND DESCRIPTIONS.

Note: All of the types, except that of *Pallium dendyi* are in the collection of the New Zealand Geological Survey.

a. CLASS PELECYPODA.

Genus ARCA Linné, 1758.

Type: *Arca noae* L.

Arca pittensis n. sp. (Figs. 5, 6.)

Shell of moderate size, thin, rhomboidal, inflated, beaks at anterior sixth, distant; posterior area flattened, bounded below by strong ridge running from umbo to bottom of short and obliquely-truncated posterior margin. Sculpture of disc mostly worn away, but as far as can be seen consisting of spaced radial threads, arranged in pairs with wide interstices, the whole crossed by strong growth-lines; posterior area has crowded, wavy, radial threads, 3 to 4 per millimeter, rendered irregularly moniliform by growth-lines. Hinge long and narrow with a central smooth area not coinciding with angle of ligamental chevrons; behind this smooth space are 13 oblique teeth, in front from 12 to 14; the posterior 5 of the latter inclined upwards and backwards. Ligamental area very broad with about 14 well-marked ligamental chevrons; ventral margin of valves irregularly, weakly dentate.

Height 15 mm.; length 30 mm.; thickness (1 valve) 10 mm.

Locality: Flower-pot Harbour, Pitt Island.

Remarks: This species is related to *Arca subvelata* Suter from Target Gully, but has a shorter posterior margin and so a different shape, also the ligamental grooves are more crowded.

Genus BARBATIA Gray, 1847.

Type: *Arca barbata* Linné.

a. Subgenus *Acar* Gray, 1887.

Type: *Arca gradata* Brod. and Sowb.

Barbatia (Acar) whangaensis n. sp. (Figs. 1, 4.)

Shell small, subrhomboidal, beaks about anterior fourth, curved strongly forward; anterior end horizontal for short distance above,

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then regularly rounded, posterior broader than anterior, horizontal above, then very obliquely truncated, ventral margin with broad shallow sinus; rounded ridge bounding posterior area runs from umbo to postero-ventral corner. Sculpture of about 12 primary ribs which by anastomosing produce about 24 at adult margin; these are crossed by very strong regular concentric growth-ridges raised on radials into strong scales. Teeth 6 to 8 anterior and 10 to 12 posterior, not separated by smooth space. Area very narrow, not well defined anteriorly, one strong groove bounding the area running from beak to end of hinge-line, but seldom any others and then they are quite short. Valve-margin crenulated.

Height 4 mm.; length 7 mm.; thickness (1 valve) 2 mm.

Locality: Titirangi.

Apparently closely related to *Arca sociella* Brookes from North Auckland and to *Arca botanica* Hedley from southern and eastern Australia, but with fewer ribs than either of these.

b. Subgenus *Pugilarca* nov.

Type: *Barbatia barneaformis* Marwick.

Differs from *Barbatia* and *Acar* in having a wide space devoid of teeth on the central part of the hinge. The teeth have not been obliterated by a descending area, but have never developed. The beaks are nearer the anterior end than in either of these genera and the area like that of *Acar* is very narrow, having only one straight groove, which is behind the beak. The sculpture though fundamentally the same presents a very different appearance because the radial and concentric elements are about equally developed, the ribs are coarse and the interspaces are wide. The valve-margins are smooth as far as can be seen, not crenulated like those of *Acar*.

***Barbatia (Pugilarca) barneaformis* n. sp. (Figs. 2, 3.)**

Shell rather small, subrhomboid, fragile, beaks at anterior fifth; anterior end narrowly convex, posterior end with straight dorsal margin and slightly convex, obliquely truncated posterior margin, ventral margin broadly convex, ascending in front; a prominent rounded ridge runs from umbo to blunt posterior ventral angle. Sculpture: middle and anterior of disc with about 20 primary radials with secondaries appearing later and equalling the primaries, all bearing strong tubercles, surface of disc has regular concentric growth-ridges about 0.6 mm. in width, posterior area has 7 weak radials of same structure as the others. Hinge narrow, four anterior teeth separated by wide space from 12 oblique posterior teeth. Area linear, a single ligamental groove extending backwards from umbo along top of teeth a little over half way to postero-dorsal angle. Valve margins smooth, sharp.

Height 11.5 mm.; length 21 mm.; thickness 5 mm.

Locality: Flower-pot Harbour, Pitt Island.

Genus LISSARCA Smith, 1877.

Type: *L. rubrofusca* Smith.**Lissarca fossilis** n. sp. (Figs. 24, 25.)

Shell very small, oval, inflated, beaks small, close to anterior end. Surface apparently smooth except for a few strong spaced growth-lines. Hinge-plate arched, narrow, with four chevroned posterior taxodont teeth and about five nearly straight anterior ones, the two sets separated by a relatively large obliquely-triangular ligament-pit. Valve-margins with about three denticles, posteriorly anteriorly, and ventrally.

Height 3.2 mm.; length 3.7 mm.; thickness (1 valve) 1.5 mm.

Locality: Flower-pot Harbour, Pitt Island.

Resembles *L. exilis* Suter, but is larger, has no trace of radial sculpture and very few marginal crenulations.

Genus GLYCYMERIS da Costa, 1778.

Type: *Arca glycymeris* Linné.**Glycymeris traversi** (Hutton).

1873. *Pectunculus traversi* Hutton, *Cat. Tert. Moll.* p. 28.

1914. *Glycymeris traversi* (Hutton): Suter, *N.Z. Geol. Surv.*

Pal. Bull. 2, p. 35, pl. 4, figs. 2a, b.

1923. *Glycymeris traversi* (Hutton): Marwick, *Trans. N.Z. Inst.*, vol. 54, p. 66, pl. 1, fig. 8.

Localities: Flower-pot Harbour, Pitt Island; Whenuataru Peninsula, Pitt Island.

Glycymeris laticostata (Quoy and Gaimard).

1835. *Pectunculus laticostatus* Q. and G., *Voy. Astrol.* vol. 3, p. 466, pl. 77, figs. 4-6.

1913. *Glycymeris laticostata* Q. and G.: Suter, *Man. N.Z. Moll.*, p. 851, pl. 56, figs. 3, 3a.

Locality: Titirangi, a single damaged specimen.

Glycymeris hunti n. sp. (Figs. 7, 10.)

Shell of moderate size, light, obliquely oval, beaks narrow, somewhat low. Sculpture consisting of fine regular radial threads, 5 per mm., superposed on a system of very low primary ribs which cannot be distinguished distally and so are of uncertain number; sometimes these ribs are slightly convex, but sometimes they are quite flat. Hinge-area somewhat narrow, teeth narrow, curved, about 15 anterior and 12 posterior without a median space; ligamental area narrow, with 6 striae about 0.5 mm. apart from each other. Valve-margin with about 50 fine crenulations the distal ones very small.

Height 35 mm.; length 40 mm.; thickness (1 valve) 10 mm.

Localities: Flower-pot Harbour, Pitt Island; Whenuataru Peninsula, Pitt Island; (?) Momoe-a-toa (cast).

This species closely resembles *G. shrimpstoni* Marwick, but this is probably a convergence for the obliquity is present from a very early stage, the young being like *G. modesta*. In *G. shrimpstoni* only some adults show obliquity, the young and many full grown ones being practically symmetrical.

Glycymeris waipipiensis Marwick.

1923. *Glycymeris waipipienis* Marwick, *Trans. N.Z. Inst.*,
vol. 54, p. 75, pl. 5, fig. 5, pl. 6, fig. 5.

Locality: Titirangi.

Only imperfect specimens were found.

Glycymeris modesta (Angas).

1879. *Axinaea modesta* Angas. *P.Z.S.*, p. 418, pl. 35, fig. 4.

1913. *Glycymeris modesta* Angas: Suter, *Man. N.Z. Moll.*, p.
852, pl. 51, figs. 8, 8a.

Locality: Titirangi, common.

Genus *LIMOPSIS* Sassi, 1827.

Type: *Arca aurita*, Brocchi.

Limopsis invalida n. sp. (Figs. 11, 12.)

Shell small, obliquely oval, moderately inflated, beaks low. Sculpture of concentric grooves separating wide flat interspaces, weak radials developed only on small portion of anterior and posterior areas. Hinge with about 5 short anterior and 5 posterior teeth, also 3 or 4 imperfect ones in the middle. Ligamental area narrow, central pit rather small. Valve-margins smooth.

Height 7 mm., length 7 mm., inflation (1 valve) 2.2 mm.

Locality: Whennataru Peninsula, Pitt Island.

L. invalida closely resembles *L. waihaoensis* Allan, but can be distinguished by its different ornamentation and slightly wider ligament pit.

Genus *PHILOBRYA* Carpenter, 1872.

Type: *Bryophila setosa* Cpr.

Philobrya galerita n. sp. (Figs. 22, 27.)

Shell minute, obliquely ovate, thin, beaks near anterior end, with raised disc-shaped prodissoconch; anterior end narrowly rounded, dorsal and ventral margins diverging towards semicircular posterior margin. Surface showing close sharp concentric ridges, and three or four marked growth-periods, also four low spaced radial ridges on posterior end. Hinge narrow, with broadly-triangular ligamental fossette, in front of which are about 10 narrow taxodont teeth and behind about 16 arranged in two tiers with third tier faintly indicated. Valve-margins sharp, bevelled, with six strong posterior crenulations; ventral margin with two or three very weak ones, the anterior margin smooth.

Height 1.2 mm.; length 1.5 mm.; thickness (1 valve) .5 mm.

Locality: Titirangi.

Only a single right valve was found. It somewhat resembles *Hochstetteria trapezina* Bernard, concerning the generic position of which Finlay (1926, p. 449) has shown there is considerable doubt.

Genus *PERRIERINA* Bernard, 1897.

Type: *P. taxodonta* Bernard.

***Perrierina ovata* n. sp.** (Figs. 8, 9.)

Shell minute, ovate, equivalve, inequilateral. Beaks fairly prominent, with a well defined, rounded, projecting prodissoconch. Sculpture of crowded microscopic concentric threads. Hinge narrow, with central triangular or trapezoidal ligament-pit separating about 4 or 5 anterior and 4 or 5 posterior teeth, all horizontal and straight except a rounded or tubercular one on each side of the central pit. Valve-margins sometimes with a few indistinct crenations on the ventral margin, sometimes quite smooth.

Height 1.5 mm., length 1.7 mm., inflation .5 mm.

Locality: Titirangi, common.

Suter has put this genus in the Crassatellitidae; but conchologically, *Perrierina* has no resemblance to this family. The writer does not know of any other shell with a hinge like *Perrierina* and so proposes the new family *PERRIERINIDAE*.

Genus *MONIA* Gray, 1849.

Type: *Anomia macroschisma* Deshayes.

***Monia furcilla* n. sp.** (Fig. 20.)

Shell small, of irregular shape according to habitat, left valve with fine, rounded, waved radial ribs sometimes anastomosing, with equal interstices, 2 to 3 per mm., crossed by close regular scaly concentric lamellae, about 5 per mm., the whole surface irregularly puckered. The muscle-scars could not be seen, so the generic position is uncertain. The shell may be an *Anomia*, but from the resemblance of its sculpture it is more likely congeneric with *Monia furcata* (Hutton) from which it differs in having more regular, much finer radial sculpture.

Height 19 mm.; length 18 mm.

Locality: Momoe-a-toa.

Genus *MYTILUS* Linné, 1758.

Type: *M. edulis* L.

Subgenus *Aulacomya* Moersch, 1853.

Type: *Mytilus magellanicus* Lam.

***Mytilus (Aulacomya) maorianus* Iredale.**

1915. *Mytilus maorianus* Iredale, *Trans. N.Z. Inst.*, vol. 47, p. 4, 484.

Locality: Titirangi.

A few damaged specimens, some with ribbing much coarser than is usual in the Recent shells.

***Mytilus (Aulacomya) willetsi* n. sp.** (Fig. 15.)

Shell very small for the group, attenuated, well inflated; beaks terminal; dorsal margin short and straight; posterior margin parallel to the anterior one, both relatively long. Sculpture of numerous waved, radial riblets many of which branch, giving a divaricate appearance. The ribs are strongest down the raised middle of the

disc and are about 2 per mm. at the ventral margin, on the anterior margin they gradually become finer until they are from 3 to 4 per mm. The hinge is not clearly exposed but there is a ligamental groove along the dorsal margin.

Height 10 mm.; length 10 mm.; inflation (1 valve) 3 mm. (holotype). A paratype is 13 x 13 x 3.5 mm.

Locality: Waikaripi below Wireless Station, Waitangi.

Family PECTINIDAE.

Before the Pectens of the Chathams could be satisfactorily classified, a rough revision of the generic and subgeneric grouping of New Zealand species had to be undertaken. The results of this survey are here presented. Suter's classification was as follows (Recent species marked*) :—

1. Genus PECTEN Muller.

A. Subgenus *Pecten*.

(1) Section *Pecten* s. str.

athleta Zittel.

(2) Section *Euvola* Dall.

**medius* Lamarck (not the West Indian species but **novae-zelandiae* Reeve, see Iredale 1924, p. 193).

B. Subgenus *Chlamys* Bolten.

(1) Section *Chlamys* s. str.

**dichrous* Suter, **imparvicostatus* Bavay, **radiatus* Hutton, **zelandiae* Gray, **zelandiae gemmulatus* Reeve, *aldingensis* Tate (not of Tate but *uttleyi* Marwick, 1924, p. 325), *chathamensis* Hutton, *semiplicatus* Hutton, *williamsoni* Zittel, *hilli* Hutton, *dendyi* Hutton.

(2) Section *Pallium* Schumacher.

**convexus* Quoy and Gaimard, *burnetti* Zittel.

(3) Section *Patinopecten* Dall.

accrementus Hutton, *beethami* Hutton, *crawfordi* Hutton, *delicatulus* Hutton (with which was synonymized *diffuxa* Hutton, wrongly so, see Thomson, 1919, p. 282) *hutchinsoni* Hutton, *marshalli* Suter, *sectus* Hutton, *triphooki* Zittel, *venosus* Hutton.

(4) Section *Aequipecten* Fischer.

devinctus Suter.

C. Subgenus *Pseudamusiun* H. and A. Adams.

(1) Section *Pseudamusiun* s. str.

hochstetteri Zittel, *waihaoensis* Suter, *yahlsensis* Ten.-Woods (not of T.-Woods but *hectori* Hutton, see Marwick, 1924, p. 326).

(2) Section *Cyclopecten* Verrill.

**aviculoides* Smith, **transenna* Suter.

D. Subgenus *Camptonectes* Meek.

huttoni Park.

2. Genus AMUSIUM Bolten.

papakurense Clarke, *zitteli* Hutton.

3. Genus HINNITES Defrance.

trailli Hutton.

The oldest *Pecten* known from New Zealand is that described by Trechmann (1918, p. 206) as *Pecten* sp. from the Upper Trias of Nugget Point. The figure looks much like that of a *Chlamys*, but insufficient material exists to show clearly.

From the Jurassic, Trechmann (1923, p. 276) described two species, *Pecten* (*Camptonectes*) cf. *lens* Sowerby and *Pecten* (*Syncyclonema*) sp. Some additional material goes to confirm the first identification; but Trechmann's second shell is not like a *Syncyclonema*. The apical angle is much greater, the ears are subequal and there is no trace of sculpture. It would be better classed as a *Pseudamussium*.

The Clarentian (Albian) beds of Marlborough have not furnished material good enough for specific determination. Woods (1917, p. 8) recorded *Pecten* (*Camptonectes*) sp., and *Pecten* (*Syncyclonema*) sp. The first has the fine divaricate striae of *Camptonectes* but I have not seen the supposed *Syncyclonema*.

Woods (1917, pp. 25, 26) also described three species from the Upper Senonian of Amuri Bluff and Selwyn Rapids.

1. *Pecten* (*Syncyclonema*) *membranaceus* Nilsson.

Syncyclonema seems to be rather loosely used by many palaeontologists for all smooth Cretaceous Pectens. The genotype, *S. rigida* Hall and Meek, is a small shell with discrepant sculpture, the right valve having weak radials and the left spaced concentric ridges. Also the ears are noticeably unequal, horizontal along the top in both valves, and meet the disc in a regular curve. The byssal sinus is apparent in both valves. The New Zealand shells have equal, high, unsinused ears, and both valves have fine regular concentric ridges; therefore they do not belong to *Syncyclonema*. No specimens or figures of the typical *P. membranaceus* are available in New Zealand, so a safe criticism of the specific placing of our shells cannot be made. Stoliczka's figures of supposed *P. membranaceus* from the Ariyalur, stated by Woods to be "closely allied to or identical with this species," show shells with ears quite different from the New Zealand ones. If they are *P. membranaceus*, our shells are certainly not. It is likely that a new specific name also a new generic one are needed for these Amuri shells, but for the present they are classed as *Pseudamussium*, *sensu lato*.

2. *Pecten* (*Camptonectes*) *hectori* Woods.

The specific name was preoccupied by Hutton, 1873, consequently Morgan (in Wilkens, 1922, p. 32, footnote) substituted *P. woodsi*. This change was overlooked by Finlay (1927, p. 526) who proposed *Camptonectes selwynensis* for the species. I am indebted to Dr. Finlay for the reference to a prior *Pecten woodsi* Woldrich, 1918, *Jahrb. Geol. Reichsanst. Wien*; as a result *Camptonectes selwynensis* must be used.

3. *Pecten* (*Aequipecten*) *amuriensis* Woods.

This shell differs widely from the type of *Aequipecten*, *P. opercularis* L., which is a large though thin shell with subequal, inflated

valves, uniform, strong, not dichotomous radials, and subequal ears with a moderately deep notch. *P. amuriensis* is much smaller in size and has unequal valves, the right flattened and practically smooth, the left inflated and strongly sculptured; also the unequal ears are joined to the shell without a separating canal, and the posterior edge meets the disc on a curve. The byssal notch is very deep. These features make the creation of a new genus necessary, so *Mixtipecten* is proposed with *Pecten amuriensis* Woods as type. Perhaps *Cyclopecten* is related to this Cretaceous stock.

The early Tertiary beds of New Zealand are not rich in Pectens, but in the Otoraran they are much commoner and larger. In Hutchinsonian, Awamoan, and younger beds the family is represented by many different specific groups sometimes containing very large individuals. One of the earliest is *P. devinctus*, which has subequal valves traversed by high, broad, radial ribs, the interspaces with waved radial threads. Supposed descendants are *diffluxus*, *wollastoni* (= *sectus*), and *allani*. These shells have still subequal valves though the left may be slightly less inflated; the sculpture consists of strong, high radials which tend to anastomose with age; and the rib-interspaces have fine, regular, concentric ridges. The ears are fairly large, right-angled, subequal; byssal sinus definite but not deep. *P. crawfordi* which appeared in Lower Pliocene times may be a development from *P. diffluxus* by increased splitting of the radials. The ears are similar but the left valve is much flatter than the right, and the folding of the disc is stronger. Suter's use of *Patinopecten* for these shells is not to be recommended. *P. caurinus* Gould, the genotype, has large flat valves, the ears set on them without a separating channel; also the byssal notch is wide and deep. None of the major divisions of the Pectinidae agrees well with these New Zealand shells so the new genus *Sectipecten* is proposed with *Pecten wollastoni* Finlay (= *P. sectus* Hutton) as type.

The Mid-Tertiary *P. athleta* Zittel may be an offshoot from the main *Sectipecten* line of descent. The valves are equally inflated; but the radial ribs are rounded and the concentric ridges are irregular both in strength and disposition. The byssal notch is very deep and the right valve has narrow, paired, primary radials, whereas the left has broad, equally-spaced ones. These differences warrant the creation of the new subgenus *Athlopecten* with *Pecten athleta* Zittel as type. Suter's classification of this species under *Pecten* s. str. is offset by his placing under *Patinopecten* of *P. marshalli* which is very closely related to *S. athleta*. In *Athlopecten* the valves are equally inflated the left has broad ribs and the right, narrow, paired ones, in *Pecten* the right valve is much inflated and has broad ribs, the left is flat and has narrow ribs.

The ancestry of the Pliocene *P. triphooki* is not known. In this large shell the right valve is quite flat and the left is strongly convex. The sculpture consists of regular, radiating, fairly strong ribs, the interspaces with fine, even, concentric ridges. The ears are very large and subequal, the byssal notch being well marked, and the hinge-crura almost absent. The flattening of the right valve and the deep sinus may indicate relationship to *Chlamys*; but the absence of scales and the presence of fine regular concentric ridges as well as

the large posterior ears show that the relationship is not close. When the valves of a *Pecten* are unequally inflated, the most inflated valve has generally broader ribs than the flatter valve. Therefore the presence of broad ribs in the left valve of *S. athleta* perhaps means connection with *P. triphooki*. In any case relationship either to *Chlamys* or to *Sectipecten* is distant, so the new genus *Phialopecten* is proposed with *Pecten triphooki* as type. *P. hilli* and *P. accrementus* were, like *P. triphooki*, described from fragmentary material from the Napier limestone and are doubtfully separable from this species. Further collecting is needed to show the value of these divisions. Certainly a great number of forms are grouped round *P. triphooki* and several specific divisions are required.

The type of *Euvola*, *P. ziczac* L., has quite obsolete radial ribs in the right valve, with only linear interspaces, whereas *P. novaezelandiae* has strong ribs with wide interspaces. An ancestor of *novaezelandiae* from the Upper Pliocene of Castlecliff has very low rounded radials, but the interspaces are wide, and the shells are closer to *Pecten* s. str. Finlay (1926, p. 451) has recently proposed *P. novaezelandiae* as type of a new division, *Notovola*, because of the weak hinge-crura, flat or concave left valve "and the right valve also has none of the secondary ridges characteristic of *Pecten maximus* L., the type of *Pecten*, the ribs are higher and flatter, and the interstices deeper, smooth and narrower." *P. laqueatus* Sowerby (Pliocene and Recent of Japan) agrees in all respects with *P. novaezelandiae* except that it has twelve instead of sixteen ribs. Also *P. bellus* Conrad (Pliocene of California) and *P. larteti* Tournouer (Helvetian of Aquitaine) may belong to the group. *Notovola* is quite as distinct from *Pecten* s. str. as is *Euvola* and is therefore used here as a subgenus of *Pecten*.

The typical *Chlamys* is well represented in New Zealand, especially from about the Oligocene onward, indeed the shell figured by Trechmann (1918, pl. 21, fig. 18) from the Trias of Nugget Point, might belong to this division. From Suter's list the following species should be transferred to other groups: *uttleyi* (*aldingensis* of Suter) to *Serripecten* (*Janupecten*); *semiplicatus* and *dendyi* to *Pallium* (? *Felipes*); *hilli* to *Phialopecten*. The Ototaran *P. venosus*, which has not yet been figured, is a *Chlamys* so its classification under *Patinopecten* was wide of the mark. Suter did not see a specimen when he revised Hutton's types, but one of the types, a right valve, has since come to light. The shell is small, about 1½ inches in diameter, and has from 10 to 12 smooth, rounded radials. The interspaces, about as wide as the ribs, but flat, are also smooth for the first inch. On the last half inch they contain about four scaly threads. A left valve collected from tuffs in the Ototara limestone by Professor Park in 1916 is much flatter than the right valve, and the scaly threads are present on the ribs as well as in the interspaces. The ears are subequal and acute, with fine scaly threads. This shell probably represents an offshoot from *Chlamys* which proceeded but a short way from the main stock, for we do not know of any descendants in later deposits.

The specimens on which the Californian *P. andersoni* Arnold was identified in New Zealand (Morgan 1911, p. 72) are casts; but they

are not that species, for the ribs divide at about an inch from the apex. As far as can be seen they belong to a new species and perhaps a new group, not closely related to any known New Zealand shell.

The type of *P. scandula* has not yet turned up, and no topotypes have been encountered, so that nothing definite can be said about this species. From Hutton's description, however, it seems fairly sure that he was dealing with a *Chlamys* s. str.

Pallium in a wide sense represents one of the major divisions of the Pectinidae, its members being widely distributed. The typical species *P. plica* Lamarck, from the Chinese seas, has strong hinge-crura, so that the New Zealand shells do not fit well into *Pallium* s. str. The subdivisions of the genus are extremely confused and badly need monographing. Dall (1898, p. 696) mentions *Felipes* Locard, *Peplum* Bucquoy, Dautzenberg, and Dollfuss, and *Flexopecten* Sacco. *Nodipecten* Dall and *Lyropecten* Conrad given by Dall as independent sections are also related. Cossmann (1914, p. 312) under the genus *Chlamys* recognised the subgenus *Manupecten* Montr. 1889 (= *Felipes* Carus 1889) containing the section *Flexopecten* Sacco, but did not mention *Felipes* Locard. It is possible that one or all of the New Zealand species belong to an already separated division, perhaps to *Felipes*, so for the present *Pallium*, *sensu lato*, is recommended.

Pecten beethami and *P. hutchinsoni* belong to a group that lived in New Zealand seas during the early and middle Tertiary. The sculpture is not like that of any other division of the family, for the inflated right valve has over thirty peculiarly-bevelled, scaly, primary radials, whereas the left valve is crowded with from 60 to 80 fine, scaly, radial threads. The earliest known example is a left valve from the Waihao greensand at McCulloughs Bridge (Upper Eocene); somewhat later comes "*Chlamys*" *enfieldensis* Marwick from the Waiarekan. By Hutchinsonian times the shells had increased greatly in size, *P. beethami* being often over 6 ins. in diameter. Awamoan examples are much the same as the Hutchinsonian ones, but about this time the whole group apparently died out. *P. yahlensis* Tenison-Woods, from the Janjukian of Victoria, is an Australian representative agreeing closely with the typical *P. hutchinsoni* except in having weaker sculpture. The group has perhaps descended from an early *Chlamys*, but it is not closely connected with any known genus of the Pectinidae so the new genus *Serripecten* is proposed with *P. hutchinsoni* Hutton as type.

Serripecten seems to have an innate tendency towards obsolescence of the sculpture. Thus McCoy (1876, p. 13) described a species *P. yahlensis* var. *semi-laevis* with a smooth right valve. In New Zealand are a number of species showing smoothing of the left valve, or of both valves, but none in which the right has proceeded further along this road than the left. *P. uttleyi* Marwick (1924, p. 325) is a good example of this loss of sculpture. Considerable variation is met with in this shell, but some right valves show clearly the resemblance to *Serripecten*. *P. hochstetteri* Zittel as interpreted by Park and Suter (but not by Hutton) also belongs to this group, as was noticed by Tate. Other specimens from several localities of Otoraran

and Huthinsonian age show this smoothing of the left valve, and supply clear links with *Serripecten*. It is certain that the tendency extended over a long period, and so all shells with weak sculpture in the left valve are not necessarily directly related. In *P. uttleyi*, however, the obsolescence of sculpture has gone so far that the general appearance of the shell is quite different; consequently the new subgenus *Janupecten* with *P. uttleyi* as type is proposed. The ribbed shell included in Zittel's *P. hochstetteri*, and named below *S. polemicus*, can also be classed as *Janupecten*.

When Zittel (1864, p. 50) described *P. hochstetteri*, he had material belonging to two species, the first with two smooth, shining valves, the second with the left valve finely concentrically striated and the right with obsolete radials. That this was so can be proved by several lines of evidence. Thus his figures, supposed to show a right and a left valve are really of two right valves. Also in his description he says the left valve is "laevigata, interdum striis concentricis ornata." This includes the two species, for the shell with a radially ribbed right valve always has a concentrically striated left valve, not a smooth one; though, as pointed out to me by Dr. Finlay, this could refer to weathered material of the ribbed species. The localities given by Zittel are Whaingaroa and Aotea, Auckland; and Cape Farewell, Nelson. At Whaingaroa and Aotea both species occur, but at Cape Farewell only the smooth shell is found. The evidence of the localities alone shows that two species were confused; and since the locality is a vital part of a description, it cannot be assumed that Zittel's description applies to only one species. Further, Zittel said that the left valve was smooth or concentrically striate, and the right valve weakly ribbed. The statement, as it stands, applies to the ribbed shell accurately enough; but quite possibly this agreement is apparent only. Whether Zittel regarded the byssal notch as anterior or posterior is not clear. At the time he wrote, opinion was divided on the subject, and the descriptions of other species in the "Novara" publication are not conclusive. The evidence afforded by *P. athleta*, however, seems to indicate that Zittel's left valve was what we call the right. Also, fig. 5a of *P. hochstetteri*, said by him to be a left valve, shows the byssal sinus plainly, whereas in the original of fig. 5b the ears are badly broken. This tends to show that the smooth right valve figured by Zittel was used by him for his description of the supposed "left" valve, and was not mistaken by him for a true left valve in the modern sense. At all events, there can be no doubt that Zittel handled two species and that his description and figures include both. Therefore, when Hutton (1873, p. 30) selected the shell with two smooth valves as *hochstetteri* and expressly excluded the ribbed shell he was quite within his rights, and the choice cannot be altered. His reference is "Zittel, Voy. Novara, Palae., p. 50, pl. XI, f. 5a, not 5b." This course was approved by Tate (1886, p. 114) who correctly stated that the shell having a ribbed valve was apparently related to *P. yahlensis* T.-Woods.

Hutton's deliberate choice of the smooth shell for *P. hochstetteri* was overlooked by Park (1905, p. 485) who took it for granted that *P. hochstetteri* should refer to the ribbed one (Zittel, pl. 11, f. 5b)

and gave the name *Pseudamussium huttoni* to the smooth. *P. huttoni* is therefore a synonym of *P. hochstetteri* and the latter must be used. The species with a weakly-ribbed right valve and a concentrically-lined left one being without a name, *Serripecten polemicus* is proposed, and a specimen from loc. 993, coast, section 70, block 19, Whaingaroa Survey District, is chosen as type.

The origin and relationships of *P. hochstetteri* are not clear. The small, smooth, Cretaceous shell identified by Woods as *P. membranaceus* Nilss. has no byssal notch, but otherwise closely resembles *P. hochstetteri*, and may well be ancestral. On the other hand it is possible that the smooth valves result from obsolescence of sculpture as in *Janupecten*; but more collecting is needed to settle this point. Suter's species *P. waihaoensis* is almost certainly closely related to the *P. hochstetteri* stock, for the ribs in the right valve are extremely weak, though whether obsolete or rudimentary cannot be determined. Perhaps a connection exists through this species with *P. devinctus*.

Occurring in the same locality as *P. waihaoensis*, i.e., Waihao Downs (Eocene) is an unnamed species with both valves smooth, and at McCullochs Bridge is yet another species distinct from *P. hochstetteri*. Probably many other species exist in the Oligocene and Miocene of New Zealand and have been lumped in with *P. hochstetteri*; but much more material is required to make satisfactory divisions. For the present, it is advisable to treat all New Zealand Tertiary Pectens with two smooth valves as belonging to one generic stock, though it is not certain that they do. For this group the new genus *Lentipecten* is proposed with type *Pecten hochstetteri* Zittel (Pl. 11, fig. 5a, as limited by Hutton = *P. huttoni* Park).

The prominent ribbing on the left valves of *P. waihaoensis* and *P. imperfectum* seems worth subgeneric recognition so *Duplipecten* is proposed, with type *P. waihaoensis* Suter.

Suter apparently thought that the two valves of *waihaoensis* figured by him belonged to one individual, for his MS. label with them has the word "holotype" on it. We do not know what is the evidence for his opinion, and possibly another species related to *L. hochstetteri* is represented by the fragmentary right valve. Therefore the left valve (Suter, 1917, pl. 7, fig. 15) is here designated lectotype of *P. waihaoensis*.

The Chatham Island Tertiary *P. hectori* has no known close relatives in the New Zealand region, but it agrees very well with the east North American *Placopecten*. This resemblance might be due to convergence, but since there is no evidence to connect *P. hectori* with any species of the south-west Pacific, *Placopecten* can be used, at least until more is known on the subject.

Until now, all internally-ribbed shells in Australia and New Zealand have been called *Pecten*, or *Amussium*, *zitteli*; but there are two quite distinct groups in the Tertiary of both countries. One has both valves similar and almost smooth with subequal ears not showing a byssal sinus, whereas the other has discrepant valves, the left with well-marked radial sculpture and the right with concentric only, also the byssal notch is well developed. Hochstetter (1864, p. 53, pl. 19, figs. 1b, 3 under *Pecten* sp. described the cast of a shell with

obtusely angled ears from Papakura (30 mm. high according to the figure). Later, on the same page, he mentioned a small shell from Orakei Bay (8 mm. high) as perhaps belonging to the same species. An internal cast was figured (pl. 9, fig. 1b) and on the same block are four other shells of similar size. Three of these are smooth, and one indicates by the unequal ears that it is a right valve. They were named *P. aucklandicus*. The remaining specimen shows the exterior of a shell with radial ribs and ears of about the same size as those of the *Amussium* and the *P. aucklandicus*. Zittel thought it might be *P. fischeri*, but neither the apical angle nor the number of ribs corresponds. The right ear is shown in the figure slightly larger than the left, but the shell is probably not a right valve for there is no sign of a byssal notch. This brings us to the question of whether all these shells might not belong to one species of *Variamussium*. Only an examination of the type or of topotype material will settle this.

Hutton (1873, p. 32), with material from several localities, gave the name *Pecten zitteli* to these internally-ribbed shells and referred to Zittel p. 53, though not to any figure. He described the shells as smooth and with ears equal and obtuse, height 0.85 inch (= 22 mm.).

Tate (1886, p. 115, pl. 7, figs. 3 a-c) ascribed to *P. zitteli* Hutton specimens from five Australian localities, giving as dimensions 10 mm. x 9.5 mm. His excellent material showed discrepant sculpture on the two valves, so he gave a full description and figures, and thought that Hutton was wrong in saying that both valves were smooth.

The type of *P. zitteli* was not chosen until Suter (1914, p. 44, pl. 6, figs. 5 a, b) selected Hutton's specimen from Whangape Lake. The figure published by Suter is from an old, idealized drawing by Buchanan, probably from the type which has the measurements given by Hutton. The valves are not smooth, however, having fine concentric sculpture, but there are no external radials. Suter's description is only a quotation of Tate's, following that author's mistaken idea of which was the right and which the left valve. It is therefore based on a shell quite different from *A. zitteli* and requiring a new name.

Tate was right in saying that some New Zealand shells showed discrepant sculpture, but they are without a name unless indeed they are Zittel's *P. aucklandicus*.

The true *P. zitteli* appears to agree with *Parvamussium* Sacco; but I have not had access to Sacco's work or to specimens of the genotype, *P. duodecimlamellatus* Bronn.

The shells with discrepant sculpture can be classed as *Variamussium* Sacco type *Amussium cancellatum* E. A. Smith (*vide* Cossmann. Dall, following Verill and Busch, gave "Schmidt" and could not identify the shell).

Clarke's species *A. papakureense*, established because of the inequilateral shape, may be the same as *A. zitteli*. The present shape is probably due in large part to rock distortion.

Much confusion exists as to the spelling of *Amussium* and the many derived words such as *Pseudamussium*, *Parvamussium*, etc. Bolten's original spelling is *Amusium*, and this form has been followed by Dall and most modern American writers. Many European authors,

however, including those who introduced most of the derived words, used the double 's.' For the sake of uniformity Dall altered the compound words to agree with Bolten's spelling; but since the correct spelling of the Latin word is Amussium (a wheel to indicate wind direction) it would surely be better to recognise the emendation of Bolten's usage.

Hutton's type of *Hinnites trailli* has been recovered. It is a left valve agreeing closely with the shells not uncommon at Target Gully. The sculpture is finer than that of the genotype of *H. crispus* Brocchi; but the other shell-characters show that we are dealing with a true *Hinnites*. The muscle-scar is large and circular, the pallial impression is of small diameter, the resiliary pit is long and narrow, and there are no hinge-crura. The genus is known in New Zealand only in the Awamoan stage, i.e., approximately Lower Miocene.

Finlay (1926, p. 452) has proposed *Cycloclamys* for the recent *Cyclopecten transenna* (Suter), at the same time admitting as true *Cyclopecten* an unnamed species. Dr. Finlay kindly forwarded his material for re-examination and wrote that the single right valve on which his description was based could not be found and was probably broken. He felt pretty sure, however, that it really was a right valve for he had gone into the matter carefully. Nevertheless it seems likely that a mistake was made. From the type locality there are two smooth right valves which have a damaged posterior ear, without a separating groove, and a large scalily-ribbed, deeply-notched, anterior one, and for which no left valve, unless *C. transenna*, have been found. Also, from shell-sand, Mason's Bay, Stewart Island, Mr. A. W. B. Powell has separated left valves of *transenna* and right valves as described above. In these the posterior ear is shown to be large, but not defined by a groove, the posterior edge of the shell being almost vertical. The evidence is fairly conclusive that these are indeed the right valves of *C. transenna*, which consequently agrees with *Cyclopecten* in general character. Whether *Cycloclamys* can be retained as a division of *Cyclopecten* had perhaps better be settled by a comparison of actual specimens.

Summary of N.Z. Pectinidae.

1. Genus PECTEN *Mueller*, 1776.
 Type: *Ostrea maxima* L.
 Subgenus *Notovola* Finlay, 1926.
 Type: *P. novaezelandiae* Reeve.

**novaezelandiae* Reeve.

2. Genus *Chlamys* Bolten, 1798.
 Type: *Pecten islandicus* Mueller.
 Subgenus *Chlamys* s. str.

**campbellicus* Odhner 1924, **celator* Finlay 1927, *chathamensis* (Hutton), **consociata* E. A. Smith 1915, *delicatula* (Hutton), **dichrous* (Suter), *fischeri* (Zittel), **imparicostata* (Bavay), *mercuria* n. sp., *oamarutica* Murdoch 1924, **radiata* (Hutton), ? *scandula*

(Hutton) not seen, *seymouri* n. sp., **suprasilis* Finlay 1927, *titi-rangiensis* n. sp., *venosa* (Hutton), *Chlamys* sp. (Trechmann) Triassic.

3. Genus *PALLIUM* Schumacher, 1817.

Type: *Pecten plica* Lamarek.

? Subgenus *Felipes* Locard.

Type: *Ostrea pesfelis* Linné.

burnetti (Zittel), **convexum* (Q. and G.), *costato-striatum* (Marshall), *dendyi* (Hutton), *kaiparaense* (Finlay) 1924 (= *P. subconvexus* Marshall), *marionae* (Finlay) (= *semi-plicatus* Hutton), ? *polymorphoides* (Zittel); *syagrus* (Marwick) 1924.

4. Genus *SECTIPECTEN* nov.

Type: *Pecten wollastoni* Finlay (= *Pecten sectus* Hutton).

(1) Subgenus *Sectipecten* s. str.

Shell large, strong, subequilateral, both valves inflated, right sometimes more than the left; ears large, subequal, byssal sinus restrained, no ctenolium. Sculpture: right valve with about eight strong, rectangular folds separated by somewhat narrower, flat interspaces. The ribs later on divide, but the divisions remain grouped together and raised above the interspace which by now has developed one to three secondary ribs. Left valve with about eight strong ribs with much wider, flat interspaces. The ribs are generally grooved down the middle, sometimes deeply so and appear as double ribs. Secondary grooves are also developed, and in the interspaces are from two to five riblets. The whole surface except the flat summits of the ribs in the right valve with crowded, fine, regular, sharp concentric ridges. Hinge-crura scarcely developed.

allani n. sp., *crawfordi* (Hutton), *devinctus* (Suter), *diffluxus* (Hutton), *wollastoni* Finlay.

(2) Subgenus *Athlopecten* nov.

Type: *Pecten athleta* Zittel.

Shell large, strong, equilateral, ears large, subequal, byssal notch deep and wide, no ctenolium. Sculpture: right valve with about 11 low rounded radials, left with double the number of much narrower, paired ribs, interspaces with secondaries appearing during growth. Sharp, irregular concentric lamellae on ears and distal parts of shell. *athleta* (Zittel), *marshalli* (Suter).

5. Genus *PHIALOPECTEN* nov.

Type: *Pecten triphooki* Zittel.

Shell large, equilateral, right valve flat, left valve well inflated. Ears large, subequal; byssal notch narrow but well marked, no ctenolium. Sculpture: both valves with twenty to thirty strong, rounded ribs with narrow interstices. The ribs soon develop a weak central groove and the interstices a central thread, sometimes these increase in number until the whole surface is faintly corrugated.

The interstices and the sides of the ribs are crowded by fine regular sharp concentric ridges.

accrementus (Hutton), *hilli* (Hutton), *triphooki* (Zittel).

6. Genus *SERRIPECTEN* nov.

Type: *Pecten hutchinsoni* Hutton.

(1) Subgenus *Serripecten* s. str.

Shell fairly large, equilateral; right valve more inflated than left; ears subequal, right anterior one slightly larger than posterior. Sculpture: right valve with over thirty strong, sharp, scaly, bevelled ridges, often with a scaly secondary thread in the interstices. Left valve with about seventy scaly threads, many of which have appeared during growth.

beethami (Hutton), *enfieldensis* (Marwick), *hutchinsoni* (Hutton), *tiorioriensis* n. sp.

(2) Subgenus *Janupecten* nov.

Type: *Pecten uttleyi* Marwick.

Shell of moderate size, equilateral, equivalve; ears subequal, those of right valve ascending distally; byssal notch well developed, no ctenolium. Sculpture: right valve with over fifty weak radials, bevelled towards extremities; left valve smooth, or concentrically lined, sometimes with obsolete radials appearing distally.

polemicus n. sp. (= *hochstetteri* of Park, not of Hutton), *uttleyi* (Marwick).

7. Genus *LENTIPECTEN* nov.

Type: *Pecten hochstetteri* Zittel, pl. 11, fig. 5a.

(= *Pseudamussium huttoni* Park.)

(1) Subgenus *Lentipecten* s. str.

Shell of moderate size, equilateral, equivalve, gaping; ears subequal, separated from valve by only shallow groove, those of right valve ascending distally; byssal notch well developed, no ctenolium. Both valves smooth and shining, with traces of very fine concentric lines. Interior smooth.

hochstetteri (Zittel).

(2) Subgenus *Duplipecten* nov.

Shell of moderate size, equilateral, equivalve, gaping; ears subequal, those of right valve ascending distally on dorsal margin, and separated below from disc by channel; byssal notch well developed, no ctenolium. Right valve almost smooth, with faint, spaced radials. Left valve with broad, low, spaced radials which show weakly internally.

waihaoensis (Suter), *imperfectus* n. sp.

8. Genus *PLACOPECTEN* Verrill 1897.

Type: *Pecten clintonius* Say.

hectori (Hutton).

9. Genus PSEUDAMUSSIUM H. and A. Adams, 1858.

Type: *Pecten pseudamussium* Sowerby
(= *exoticus* Chemnitz).

? *membranaceus* (Nilsson), ? new sp. Upper Senonian; ? *Pseudamussium* sp. (Trechmann) Jurassic.

10. Genus CAMPTONECTES Meek, 1864.

Type: *Pecten lens* Sowerby.

cf. *lens* (Sowerby) Jurassic; *Camptonectes* sp. (Woods) Albian; *selwynensis* Finlay Upper Senonian.

11. Genus SYNCYCLONEMA Meek, 1876.

Type: *Pecten halli* Gabb (= *P. rigida* Hall and Meek).

? *Syncyclonema* sp. (Woods) Albian.

12. Genus MIXTIPECTEN nov.

Type: *Pecten (Aequipecten) amuriensis* Woods.

Shell small, right valve almost flat, left well inflated; ears large, subequal, not ascending, joining disc without channel; byssal notch very deep. Sculpture: right valve almost smooth, with a few weak radials at extremities; left valve with many narrow but strong primary radials with wide flat interspaces which are sometimes traversed by a secondary radial, and which have somewhat irregular, spaced, concentric ridges.

amuriensis (Woods).

13. Genus CYCLOCHLAMYS Verrill, 1897.

Type: *Cyclopecten pustulosus* Verrill.

**secundus* (Finlay), **transenna* (Suter).

14. Genus PARVAMUSSIUM Sacco, 1897.

Type: *Pecten duodecimlamellatus* Bronn.

zitteli (Hutton), *papakurensis* (Clarke) (perhaps = *zitteli*).

15. Genus VARIAMUSSIUM Sacco, 1897.

Type: *Amussium cancellatum* E. A. Smith.

Variamussium spp. unnamed, or ? *aucklandicus* (Zittel).

16. Genus HINNITES Defrance, 1821.

Type: *Ostrea crispa* Broochi (= *Hinnites cortesyi* Defrance).

trailli Hutton.

Chlamys chathamensis (Hutton). (Figs. 18, 19.)

1873. *Pecten chathamensis* Hutton, *Cat. Tert. Moll.*, p. 29.

Shell somewhat small, thin; both valves moderately inflated. Ears very unequal. Sculpture: right valve with about 17 rather narrow, strong, scaly ribs with wider interstices; on each flank of the ribs, beginning some distance from the umbo is a weak scaly thread;

anterior ear with 5 strong scaly ribs; posterior ear very small, with about 4 weak, well spaced scaly ribs. Left valve similar to the right, but with about 20 ribs; a few posterior ones noticeably weaker; anterior ear with fairly straight outer edge, with 7 weak well-spaced scaly ribs a secondary in the two top interspaces; posterior ear with about 4 weak, widely spaced scaly radials.

Height 26 mm., length 22 mm., inflation (1 valve) 4.5 mm.

Localities: Flower-pot Harbour, Pitt Island; Momoe-a-toe.

Hutton gave as localities for his species "Chatham Islands; Castle Point, East Coast, Wellington; Broken River (L)," and when Suter (1914, p. 40, pl. 6, fig. 6) revised the old Geological Survey collection, he named the specimen from Broken River as type. This does not seem correct procedure, because the specific name *chathamensis* should by tautonymy be reserved for the Chatham Islands shell. Therefore a neotype (Fig. 18) from Flower-pot Harbour has been selected.

The strength of the scales on the ribs varies considerably, some specimens being almost smooth.

***Chlamys seymouri* n. sp. (Fig. 23.)**

Shell large, thin, compressed, subcircular, slightly oblique. Apical angle acute, widening with age. Ears very unequal, anterior sinus deep. Sculpture: right valve with about 18 narrow primary ribs with very wide concave interstices with 8 and 10 or even more, scaly riblets of which two are often stronger than the others, these two appear on the sides of the primaries about 10 mm. from apex and the others follow later, their relative strength corresponding with their time of appearance; anterior ear with 4 scaly radials; posterior with 8. Left valve with about 20 narrow primaries, the wide concave interstices with two secondaries sometimes almost as strong as the primaries, each secondary interspace with 3 to 7 scaly riblets of irregular strength; anterior ear with about 15 spaced scaly radials of which 6 are stronger than the others, posterior with about 10.

Height 77 mm., length 73 mm., thickness (1 valve) 10 mm.

Localities: 1176, Momoe-a-toa; (?) Whenuataru Peninsula.

Remarks: Sometimes the primaries are smooth and much stronger than the interstitial riblets, giving the shell a resemblance to *C. delicatula* which, however, has more ribs. At other times the strength of the ribbing is very regular, making the shell look like a large *C. radiata*. Small specimens are often indistinguishable from *C. radiata* except by the vertical outer edge of the left anterior ear. *C. seymour* is a development of *C. chathamensis* in which there are many additional secondary riblets, all the radials having strong scales.

***Chlamys mercuria* n. sp. (Fig. 17.)**

Shell small, ovate, strong, inflated, equilateral; ears very unequal; apical angle acute; right valve with 21 smooth, rounded, rather flat ribs with narrower interstices strongly marked with *Camptonectes* striation, anterior ear with a broad rib above and a narrow one below, left valve with about 22 radials narrower and stronger than those of right valve, interstices similarly striated.

Height 13 mm.; length 12 mm.; thickness (1 valve) 2.5 mm.
Locality: Waikaripi, below Wireless Station, Waitangi.

Chlamys titirangiensis n. sp. (Fig. 28.)

Shell of moderate size, subcircular, slightly inequilateral, apical angle about 95° , ears very unequal. Sculpture of right valve consisting of about 40 strong radial ribs many of them arranged in pairs and some double, the posterior and anterior ones noticeably finer; interstices somewhat narrower than the ribs and often with a central thread. Scaly concentric ridges are well developed in the interstices but are absent on the summits of the ribs (this may be due to wear). Anterior ear with five radials interstices crossed by spaced scaly ridges.

Height 37 mm.; length 36 mm.; thickness (1 valve) 6.5 mm.
Locality: Titirangi.

Pallium dendyi Hutton. (Fig. 29.)

1902. *Pecten dendyi* Hutton, *Trans. N.Z. Inst.*, vol. 34, p. 196, pl. 8.

1915. *Pecten (Chlamys) dendyi* Hutton: Suter, *N.Z. Geol. Surv. Pal. Bull.* 3, p. 52.

The number of primary radial ribs is variable. Hutton's type with 9 in right valve and 8 in left is perhaps the commonest. On right valve the four strong central ribs are arranged in two pairs, each of which sometimes has the form of a single, broad rib with only a shallow indentation down centre. It is then extremely like *P. convexum*. In these cases, as a rule, the secondary ribbing is not strongly developed. The anterior primary rib in right valve is often not developed. The first or anterior rib is sometimes absent from left valve and there is considerable difference in strength of 6th rib.

Holotype in Canterbury Museum.

Dimensions of plesiotype, height 66 mm.; length 70 mm.; thickness of both valves 27 mm.

Locality: Momoe-a-toa.

Serripecten tiorioriensis n. sp. (Fig. 14.)

Shell rather small, fragile, subcircular, compressed, apical angle obtuse, inflation moderate, right probably more inflated than left; ears unequal; right valve with about 38 narrow, smooth, rounded ribs with smooth interstices of equal or slightly greater width. About 30 mm. from apex, ribs become sharp and scaly and a scaly riblet appears in each of the interstices, anterior ear with 5, posterior with 6 strong radials.

Height 41 mm.; length 42 mm.; thickness (right valve) 6 mm.

Locality: Tioriori.

Five good specimens were collected but all are right valves, consequently the left valve is unknown. The species is closely related to *Serripecten hutchinsoni*, but is much more primitive as the characters showing most resemblance appear at a late stage. It is at about the same stage as *S. enfieldensis* Marwick from the Waiarekan tuffs but has more primary ribs.

Sectipecten allani n. sp. (Figs. 13, 21.)

Shell large, strong, subcircular, apical angle obtuse, both valves inflated, right more than left. Ears unequal, anterior sinus shallow. Sculpture somewhat variable; type has in right valve 9 broad flat ribs, separated by interstices about half their width, the ribs have vertical sides and so their cross section is quadrangular, on their surfaces are faintly impressed from four to six broad secondary ribs. Interspaces have one strong narrow median rib throughout nearly the whole length, with weak one on each side coming in later. On anterior and posterior distal portions of disc are about five narrow radial riblets. Whole surface is covered with fine regular concentric ridges which in rib interspaces and on ears become much stronger and sharply raised, posterior ear with three obsolete, widely-spaced radials, anterior with 4 strong spaced radials and some secondaries. Left valve with 9 rather narrow, strong, rounded primary ribs which are weakly divided from about one inch from apex, some ribs have indications of still further division of each half. Interspaces are twice as wide as ribs, corresponding to the ribs of right valve; each has from 3 to 4 strong, rounded, secondary riblets, whole surface including ribs and ears covered by dense, sharp raised concentric growth-ridges; each ear with about 3 obsolete radial threads.

Height 98 mm.; length 104 mm.; thickness of right valve 13 mm.; left valve 10 mm.

Locality: 1176, Momoe-a-toa.

Remarks: This is the largest and probably the commonest shell in the *Pecten* bed at this place. Some specimens reach 120 mm. in diameter. The inflated specimens have generally strong primary but weak secondary ribbing. Other shells have on the right valve rather weak primaries which are divided almost up to the apex, one or both limbs being grooved. These variations approach *Sectipecten wollastoni* Finlay (= *sectus* Hutt.); but in no case is strong primary ribbing accompanied by deep secondary grooving. The two species are closely related, but *S. allani* seems to be the less advanced, for the inflated adults are at about the stage represented by *S. wollastoni* of 30 mm. diameter.

Sectipecten toaensis n. sp. (Fig. 16.)

Shell rather small for the group, subcircular, somewhat compressed, apical angle 90°, valves almost equal, ears unequal, right valve with 33 strong regular quadrangular ribs separated by interstices of equal width, about 3 weak radial riblets anterior to primaries, interstices and sides of ribs crowded with sharp concentric ridges, near apex are shallow folds so weak that the number is uncertain, left valve with 35 somewhat irregular quadrangular ribs, there are 7 or 8 very weak folds the central one strongest, on summits of these folds the ribs are stronger than in interspaces, anterior ear with 6 sharp rough spaced radials, posterior with 7 smooth ones the top two stronger than others.

Height 49 mm.; length 47 mm.; thickness (l.v.) 9 mm., (r.v.) 8 mm.

Locality: Momoe-a-toa.

Remarks: Related to *Sectipecten crawfordi* which has the folds well developed and more ribs.

Placopecten hectori Hutton.

1878. *Pecten hectori* Hutton, *Cat. Tert. Moll.* p. 30.

1887. *Pecten yah lensis* Tenison-Woods: Hutton, *P.L.S.*, N.S.W. (2) vol. 1, p. 235.

1914. *Pecten* (*Pseudamusium*) *yah lensis* Tenison-Woods: Suter, *N.Z. Geol. Surv. Pal. Bull.* 2, p. 43, pl. 7, fig. 3.

1924. *Pecten hectori* Hutton: Marwick, *Rep. A.A.A.S.* vol. 16, p. 326, pl. 6, fig. 1.

The sculpture of the left valve is similar to that of the right, i.e., numerous radial incised lines separating sometimes broad interspaces, sometimes narrow ribs

Locality: Flower-pot Harbour, Pitt Island.

Fragments of a large *Pecten* with a great number of radial ribs were collected from the bryozoan, tuffaceous limestone at Waitangi. This may be a left valve of *P. hectori*.

Lentipecten (Duplipecten) imperfectus n. sp. (Figs. 30, 31.)

Shell rather small, fragile, subcircular, apical angle obtuse. Both valves equally and moderately inflated. Ears probably subequal. Right valve practically smooth, with microscopic "*Camptonectes*" radials; left valve with about 50 smooth, low, broad, radial ribs with narrow interstices showing *Camptonectes* striation.

Height 27.5 mm.; length 27 mm.; thickness (both valves) 8 mm.

Locality: Tioriori.

The classification under *Lentipecten* is tentative for there are several points of disagreement, e.g., sculpture and shape of the ears.

Genus *LIMA* Cuvier, 1798.

Type: *Ostrea lima* Linné.

Lima vasis n. sp. (Fig. 38.)

Shell large, but rather thin, little inflated, beaks low. Posterior ear fairly large. Sculpture of 22 narrow but strong, rounded ribs separated by concave interstices at first equal to the ribs but rapidly widening until they are about three times as wide, the ribs flatten out towards the margin, concentric lines rather stronger on the crests of the ribs and on the posterior ear which has two weak radial threads.

Height (estimated) 80 mm.; length (estimated) 65 mm.; thickness of 1 valve 14 mm.

Locality: Flower-pot Harbour, Pitt Island.

Genus *LIMATULA* Searles Wood, 1839.

Type: *L. subauriculata* Montagu.

Limatula maoria Finlay.

1913. *Lima* (*Limatula*) *bullata* Born: Suter, *Manual N.Z. Moll.*, p. 886, pl. 58, fig. 13.

1926. *Limatula maoria* Finlay, *Trans. N.Z. Inst.*, vol. 57, p. 454.

Locality: Titirangi.

The single specimen has a rather broad hinge.

Limatula morioria n. sp. (Fig. 35.)

Shell of moderate size, oval, inflated, equilateral, beaks broad, ears inconspicuous. Sculpture of 29 sharp ribs with wide concave interspaces the central ribs are strong and erect the pair on each side of the median line rather closer together, the lateral ribs are low and oblique but well spaced; sharp close concentric ridges cross the interstices and surmount the ribs rendering their edge dentate. Valve-margin crenulated.

Height 18 mm.; length 12 mm.; thickness (1 valve) 6 mm.

Localities: Momoe-a-toa (type); Whenuataru Peninsula; Flower-pot.

Remarks: Distinguished from *L. maoria* Fin., by the less attenuated shape and persistence of the broad ribbing along the sides. There is no trace of the fine crowded anterior and posterior ribs of *L. maoria*.

Genus CTENOIDES H. and A. Adams, 1858.

Type: *Lima scabra* Born.

Ctenoides naufragus n. sp. (Figs. 36, 37.)

Shell ovate, slightly inequilateral, inflated. Ears small, almost equal, right somewhat lower and stretching further down shell than left, broadly and deeply sinused for the byssus. Sculpture of from 50 to 55 low, slightly-bevelled, weakly-beaded undulating ribs divaricating from a line somewhat in front of middle of disc; some ribs more especially posterior ones divide on nearing margin; interspaces about as wide as ribs and have fine undulating, oblique threads somewhat resembling anastomosing finger-prints. Four narrow radials on posterior ear but only growth-lines on anterior one. Ligamental area somewhat narrow and short with well marked central pit. Close below area on each side is a small tubercle, and inner margin at base of each ear has another.

Height 28 mm.; length 23 mm.; inflation (1 valve) 7.5 mm.

Locality: Flower-pot Harbour, Pitt Island.

A solitary right valve of this interesting Northern genus was found by Mr. Allan. Undescribed species occur at Pakaurangi Point and Palliser Bay.

Genus LIMEA Broun, 1831.

Type: *Ostrea strigilata* Brocchi.

Limea chathamensis n. sp. (Figs. 33, 34.)

Shell rather small, thin, oblique, suboval, well inflated, beaks not much raised above the hinge-margin, ears small, surface with about 45 ribs, the anterior 12 broad and very low and with linear interstices, those on centre of disc strong and sharp with concave interspaces in each of which is a weak thread, ribs flatter and wider on posterior; hinge margin broken away, but with about 5 anterior and 5 posterior weak taxodont teeth, valve-margin crenate.

Height 14 mm.; length 12 mm.; thickness (1 valve) 4.5 mm.

Locality: Momoe-a-toa; Whenuataru Peninsula.

Iredale (1924, p. 194) has recently proposed *Notolimea* for the Australian *L. australis* Smith, but owing to lack of specimens the writer is not able to say on what differences the new genus is founded.

Genus *OSTREA* Linné.Type: *O. edulis* Linné.***Ostrea cannoni* n. sp.** (Figs. 32, 41.)

Shell large, solid, suboval, generally equilateral, rather flat, surface of attachment very large (60 mm. diameter in type). Sculpture of left valve consisting of irregular, discontinuous, waved radial folds which are intersected by a few strong, spaced, puckered, concentric lamellae, numerous crowded fine lamellae towards margins. Ligamental area very large, traversed by fairly deep, concave, triangular pit, about one-third of the total area. Muscular scar oval; nearer the ligamental margin. Valve-margins smooth.

Height 132 mm.; length 128 mm.; thickness (left valve) 50 mm. Maximum thickness of shell material 28 mm.

Locality: Tioriori.

***Ostrea waitangiensis* n. sp.** (Fig. 26.)

Shell fairly large, not heavy, kidney-shaped, with an anterior wing. Surface of attachment moderate. Left valve moderately convex, right valve concave. Sculpture, left valve with short, discontinuous irregular radials, 2-4 mm. wide, developed mostly on the posterior side; and irregular, spaced, concentric lamellae averaging perhaps 15 mm. apart. Right valve with an irregular, puckered surface. Ligamental area destroyed in the single specimen; valve-margins broadly folded.

Height 108 mm.; length 100 mm.; thickness (both valves) 38 mm.

Locality: Cliffs south of Wireless Station, Waitangi.

***Ostrea arcula* n. sp.** (Figs. 42, 43.)

Shell of moderate size, subquadrate, winged posteriorly, beaks inconspicuous. Left valve with a very large area of attachment where it is considerably thickened, but tapers rapidly to a knife-like margin; right valve thin, slightly convex at first but with a deep concavity towards outer border. Surface almost smooth, slightly lamellate towards margins, vaguely puckered postero-ventrally. Ligament triangular, moderate, directed obliquely backward, with a narrow median groove

Height 40 mm.; length 40 mm.

Locality: Momoe-a-toa.

Genus *NOTOSTREA* Finlay, 1928.Type: *Ostrea subdentata* Suter.***Notostrea tarda* (Hutton).** (Figs. 86-96.)

1873. *Gryphea tarda* Hutton, *Cat. Tert. Moll.*, p. 35.

1914. *Gryphea tarda* Hutton: Suter, *N.Z. Geol. Surv. Pal. Bull.* 2, p. 47, pl. 13, figs. 1a, b.

Localities: Bryozoan limestone, Tioriori; limestone boulders at head of Whangamoe Inlet (wrongly named Whangatete on L. and S. map, 1910); base of tuffaceous limestone, Waikaripi.

Many specimens were collected at what is probably the type locality at Tioriori where they occur in great numbers. The speci-

mens figured are not exceptional ones, but give a fair idea of the great range in width and incurving. The writer is indebted to Dr. H. J. Finlay for drawing his attention to the close relationship between *Gryphaea tarda* and *Ostrea subdentata* Suter, and for questioning the use of *Gryphaea* for Hutton's species. Trueman (1922, p. 264) writing on *Gryphaea* of the Lower Lias, had previously pointed out that this genus is based on form alone and does not represent a genetic line. He says, "It is extremely likely that these gryphaeiform shells have been evolved repeatedly during the Jurassic and Cretaceous from species of *Ostrea* that are similar and are presumably closely related. In other words '*Gryphaea*' is a polyphyletic group, containing species evolved along many different lines. Therefore, the name *Gryphaea* can only be applied strictly to one of these series, and each such series should receive a separate generic name; but until more of their characteristics are known, at least, it appears undesirable to add to the existing confusion by creating new names for each group." This objection does not apply to the Tertiary *Notostrea* of Finlay which is not likely, in New Zealand, to be confused with any other "*Gryphaea*," for none of these shells have been found in the Mesozoic of this country. However, the question of whether the South American and South Australian Tertiary examples should be classed as *Notostrea* arises. It seems likely that they also have arisen each independently in their own seas and do not indicate genetic connection.

The writer formerly thought (Ferrar, 1925, p. 295) that the posterior position of the adductor muscle, and the well-developed posterior lobe with its bounding groove showed relationship between "*Gryphaea*" *tarda* and the Jurassic *G. arcuata* Lam., but had to change his opinion after seeing some specimens of *Ostrea charlottae* Finlay from Castlecliff. These have the typical sculpture of ordinary *charlottae* but in shape, size, and other features agree with the moderately-curved specimens of *tarda*. The right valve is correspondingly modified and is extremely like the one figured below (Figs. 94-96).

It may be mentioned in passing that, following Fisher. Cossman (1914, p. 389) gives the recent *G. angulata* Lamarck as the type of *Gryphaea*, and recognizes *Liogryphaea* Fischer, founded on the Jurassic *G. arcuata* Lam. Dall, however (1898, p. 673) had previously shown that when *Gryphaea* was introduced in 1801, *G. angulata* was a *nomen nudum* and therefore without status. He argued rightly that the type must be chosen from the valid species of Lamarck's original list and named *G. arcuata* Lam. as genotype. *Liogryphaea* Fischer is therefore an absolute synonym of *Gryphaea* Lamarck.

Genus NEOGAIMARDIA Odhner, 1924.

Type: *Kellia rostellata* Tate.

Neogaimardia elegantula n. sp. (Figs. 39, 40.)

Shell minute, subovate, with short angled anterior end and long, oval posterior one. Surface polished, with microscopic concentric lines; about half way from umbo commence fine, rounded concentric folds. Left hinge with an ogee-shaped tooth in front of the umbo,

and an obliquely-triangular resilifer extending backwards from below it. Above and behind the resilifer is a long posterior lateral tooth practically parallel to the margin but approaching it in one place and suggesting that this tooth is a coalescence of two previously independent ones. Valve-margins smooth.

Height 2 mm.; length 2.5 mm.; inflation (1 valve) 0.75 mm.

Locality: Titirangi.

The shell figured by Odhner (1924, p. 69, pl. 2, fig. 57, text figs. 17-19) as *N. rostellata* Tate is of a different shape from Tate's original (1889, p. 63, pl. 11, fig. 14) and the specific identity of the Australian and New Zealand specimens is denied by Finlay (1926, p. 458). *N. elegantula* is of a different shape again, being more inequilateral than the South Australian shell and lacking the suddenly-expanded beak of the New Zealand one.

Genus *CUNA* Hedley, 1902.

Type: *C. concentrica* Hedley.

***Cuna firma* n. sp.** (Figs. 56, 57, 58.)

Shell minute, ovate, beaks very high, about anterior third, curved strongly forward; anterior end regularly convex, somewhat descending above; dorsal margin long, curved, descending steeply to the regularly convex posterior margin, basal margin regularly convex. Lunule large, shallow, not marked off. Sculpture of about 10 very low, broad ribs with linear interstices crossed by numerous strong growth-lines. Hinge-plate broad; right valve with thin weak anterior cardinal tooth slightly diverging from the lunular margin; a strong, weakly-grooved triangular median cardinal joined for half its length to a thin, oblique posterior one. Left valve with two diverging cardinals the anterior fairly thick and high, the posterior thinner and lower. Ligamental margin slightly depressed near umbo, forming with the produced and recurved lunular margin in right valve a deep notch. Valve-margin crenate.

Height 3 mm.; length 2.3 mm.; thickness (1 valve) 1 mm.

Locality: Titirangi.

***Cuna antiqua* n. sp.** (Figs. 54, 55.)

Externally similar to *C. firma* but with about 14 instead of 10 ribs. Right hinge: anterior lateral represented only by a slight thickening of the lunular margin; median cardinal strong, triangular; posterior cardinal thin, short, almost horizontal, well separated from the median. Ligamental margin very slightly depressed near umbo, separated from lunular margin by a notch. Valve-margins crenate.

Height 3 mm.; length 2.5 mm.; thickness (1 valve) 1 mm.

Locality: Whenuataru Peninsula, Pitt Island.

Genus *CARDITA* Lamarek, 1799.

Type: *Chama calyculata* Linné.

***Cardita northcrofti* n. sp.** (Figs. 44, 46.)

Shape and sculpture as in *C. aoteana* Finlay. *C. northcrofti* is easily distinguished from the Recent shell by the lunule and its effect on the hinge. In *C. aoteana* the lunule is convex only in the very

young stages. In the adult it slopes obliquely downwards and backwards, being parallel to the anterior cardinal tooth. In *C. northcrofti* the lunule remains convex in the adult and so the hinge is not so crowded. Right valve with a large triangular anterior cardinal in front of which is a wide triangular space separating it from the wide lunular margin; posterior cardinal very low. Left valve with a strong, triangular anterior cardinal sloping well forward and adjacent to the lunular margin.

Height 10 mm.; length 15.5 mm.; thickness (1 valve) 6 mm.

Localities: Flower-pot; Whenuataru Peninsula.

Genus *VENERICARDIA* Lamarek, 1801.

Type: *Venus imbricata* Gmelin.

***Venericardia beata* n. sp.** (Figs. 48, 50.)

Shell fairly large, suborbicular, plump, beaks at anterior third, high and prominent; posterior dorsal margin arched, descending to the truncated posterior end; anterior end narrower. Lunule cordate, somewhat depressed. Sculpture of 26 to 28 (rarely 22 to 25) strong, rounded radial ribs, with deep interstices which in youth are wider than ribs, but later narrower; posterior 8 ribs narrow and not so high as the others, the ribs bear closely placed, strong, transverse nodules which become scaly or spinous on posterior part of disc. Hinge of right valve with anterior cardinal tooth coalescing with lunule; median cardinal very broadly triangular; posterior obsolete, united with nymph. Left valve with strong anterior cardinal sloping forward almost parallel with lunule; posterior cardinal strong and high. Valve-margins crenate.

Height 35 mm.; length 37 mm.; thickness (1 valve) 12 mm.

Localities: Flower-pot Harbour, Pitt Island; Whenuataru Peninsula, Pitt Island.

Remarks: Strongly resembles *V. purpurata* (Desh.), but generally has more ribs, separated by wider interstices. The left anterior cardinal slopes forward not backward so that the right median is extremely broad.

***Venericardia martini* n. sp.** (Figs. 52, 53.)

Shell large, strong, suboval, moderately inflated, beaks prominent, about anterior third, anterior end short, regularly rounded, dorsal margin curved, posterior end truncated in youth, becoming narrowly rounded with age. Surface with 25 ribs, the posterior 7 rather narrow and low, remainder broad, well-raised convex ribs with narrow interstices; the ribs are regularly but weakly transversely tubercular, but in many specimens this is not seen because of the strong growth-lines which intersect the ribs and make them rugose. Lunule very small, sunken, cordate. Hinge of moderate strength, lower margin sinuous, right valve with anterior cardinal coalescing with lunule; posterior triangular, very strong; ligamental nymph deep. Left valve with a very strong anterior and a long strong curved posterior cardinal; nymph weaker than in right valve; sides of teeth and lower side of right nymph strongly striated. Valve-margins broadly crenate.

Height 50 mm.; length 54 mm.; thickness (1 valve) 17 mm.

Locality: Titirangi.

Venericardia nuntia n. sp. (Figs. 45, 47.)

Shell somewhat small, inflated, strong; beaks about anterior fourth, prominent, strongly inclined forward; anterior end narrowly rounded, dorsal margin straight, posterior end broadly truncated. Surface with 25 narrow, high, radial ribs, the 9 on the posterior area strongly dentate and close together, the rest with almost smooth crests, separated by much broader concave interspaces. Lunule cordate, deeply sunken. Hinge strong; right valve with fairly strong anterior cardinal coalescing with lunule, and strong forward curving posterior cardinal. Valve-margins crenate.

Height 13 mm.; length 14 mm.; thickness (1 valve) 5.5 mm.

Locality: Waikaripi below Wireless Station, Waitangi.

This species has a hinge similar to that of *V. beata* but the ribs are narrower, smooth, and separated by wide concave interspaces.

Genus *CONDYLOCARDIA* Bernard, 1896.

Type: *C. sanctipauli* Bernard.

Condylocardia torquata n. sp. (Figs. 61, 63.)

Shell minute, ovate, strong. Lunule rather deeply concave; escutcheon long and narrow, well defined. Prodissoconch smooth, well marked off from rest of shell by projecting, smooth collar. Sculpture of flattened, smooth, concentric ridges, separated by much narrower interspaces. Hinge of right valve with large ligament pit, a central, triangular part of which is raised; behind the pit is strong narrowly triangular cardinal tooth, separated from posterior margin by deep, narrow gap. There are no other teeth either cardinal or lateral, in this valve at least, but hinge-plate extends full length of both lunule and escutcheon and so makes anterior and posterior margins stand up prominently. Valve-margins smooth.

Height 1.5 mm.; length 1.8 mm.; inflation (1 valve) .5 mm.

Locality: Titirangi.

Only a single right valve was found. The absence of an anterior cardinal may be of generic importance, but more material is required to show whether this is a constant feature or the result of an accident.

Genus *CHAMA* Linné, 1758.

Type: *Chama lazarus* L.

Chama pittensis n. sp. (Figs. 49, 51.)

Shell of moderate size, strong, outline subcircular, left valve with a large area of attachment, umbo prominent, strongly prosogyrate, sculpture of well and regularly-spaced concentric lamellae, which are rather short and irregularly undulating, with smooth interspaces, thus producing a gradate shell surface, hinge of left valve with strong triangular cardinal tooth directly below umbo and bounded above by deep wide groove, ligamental nymph short, sunken, extending further back than cardinal tooth.

Height 30 mm.; length 27 mm.; thickness (1 valve) 18 mm.

Localities: Flower-pot Harbour, Pitt Island; Whenuataru Peninsula.

Remarks: Distinguished from *C. huttoni* Hector by relatively greater inflation, and shorter, more regularly spaced lamellae. In

C. pittensis the cardinal tooth is situated much further forward than in *C. huttoni*, and is separated from nymph by a deep depression.

Genus ZEMYSLIA Finlay, 1926.

Type: *Lucina zelandica* Gray.

Zemysia zelandica (Gray).

1835. *Lucina zelandica* Gray, Yate N.Z., p. 309.

1913. *Diplodonta zelandica* Gray: Suter, *Man. N.Z. Moll.*, p. 917, pl. 63, fig. 10.

Locality: Titirangi, plentiful.

Genus THYASIRA Lamarck, 1818.

Type: *Tellina flexuosa* Montagu.

Thyasira flexuosa (Montagu).

1803. *Tellina flexuosa* Montagu, *Test. Brit.*, p. 72.

1913. *Thyasira flexuosa* Montagu: Suter, *Man. N.Z. Moll.*, p. 919, pl. 63, fig. 11.

Locality: Whenuataru Peninsula.

Genus MYLLITELLA Finlay, 1926.

Type: *Myllitella vivens* Finlay.

Myllitella pinguis n. sp. (Figs. 68, 69, 70.)

Shell minute, subcircular, slightly oblique, well inflated; umbones fairly prominent. Sculpture of low, curved bevelled ribs 4 per mm. at margin, divaricating from a central smooth area. Left valve with small, entire, slightly oblique cardinal under umbo; and with a strong anterior and a strong posterior lateral lamella. Right valve with one or two small tubercles under umbo and with two anterior and two posterior lateral lamellae, upper one in each case almost blending with shell margin, lower one strong. Muscular impressions about equal. Valve-margins entire.

Height 3.5 mm.; length 3.75 mm.; inflation (1 valve) 1 mm.

Locality: Titirangi (common).

Distinguished from other species of *Myllitella* by its greater inflation and more sloping shoulders. *M. finlayi* (Marwick) is larger and has slightly coarser sculpture (3.5 ribs per mm.) and the Castle-cliff species, has finer sculpture (5 per mm.).

Genus ASCITELLINA nov.

Type: *Ascitellina donaciformis* Marwick.

Shell small, anterior end produced, narrowly rounded; posterior end short and broad. Sculpture of fairly strong concentric ridges. Hinge with two divergent cardinals the posterior one bifid; no laterals. Ligament external, nymphs exposed but narrow, sunk below margin, and descending posteriorly. Pallial line unknown.

Ascitellina donaciformis n. sp. (Figs. 59, 60.)

Shell very small, longitudinally oval; beaks behind the middle line, inconspicuous; anterior end long and narrowly rounded, posterior shorter and broader, roundly truncated. Sculpture of fine,

sharp concentric ridges, about 8 per millimeter on the centre of disc, many die out on reaching the posterior area where the remainder become thicker, about 4 or 5 per millimeter. Hinge weak: right valve with a narrowly-triangular, grooved posterior cardinal tooth, and a weak lamellar anterior one; no lateral teeth; ligamental nymph short, sunk below the valve-margin. Pallial line not seen. Valve-margins smooth.

Height 6 mm.; length 10 mm.; thickness (1 valve) 1.4 mm.

Locality: Cliffs below Wireless Station, Waitangi.

The only closely related New Zealand shell is an undescribed species from the Waiarekani tuffs, Lorne. It is of the same size and shape but the concentric ridges are much further apart.

Genus *AMPHIDESMA* Lamarck, 1818.

Type: *A. donacilla* Lamk.

Subgenus *Taria* Adams, 1858.

Type: *Mesodesma latum* Deshayes.

***Amphidesma (Taria) porrectum* n. sp.** (Figs. 62, 64, 65.)

Shell large, much produced in front, beaks at posterior third and fourth. Posterior end truncated, bounded by a rounded ridge running from umbo to ventral end of posterior margin; some specimens with a very weak central ridge traversing the area. Surface almost smooth, traces of rounded concentric folds, growth lines well marked distally. Hinge closely resembling that of *A. subtriangulatum* Woods, but the resilifer is relatively larger and more diverging from the posterior lateral teeth. Pallial sinus moderate. Posterior muscular impression broad.

Height 57 mm.; length 93 mm.; thickness (1 valve) 14 mm.

Locality: Titirangi.

Although there is some variation in shape this shell can be readily distinguished from *A. subtriangulatum* by the greatly elongated anterior end, and the generally strongly convex posterior end, also the pallial sinus is deeper and the posterior muscle scar somewhat larger. Some specimens have almost the same outline as *A. ventricosum* Gray, but they do not have such a strong ridge on the posterior area and the pallial sinus is shallower.

Genus *LEPTOMYA* A. Adams, 1864.

Type: *L. cochlearis* Hinds.

***Leptomya concentrica* n. sp.** (Fig. 84.)

Shell subtriangular; beaks central, very prominent; posterior end narrow, rather elevated. Sculpture of extremely fine, well spaced, low concentric lamellae, no radials.

Height 14 mm.; length 16.5 mm.; inflation (1 valve) 4 mm.

Locality: Whenuataru Peninsula, Pitt Island.

This species is represented by four closed individuals, mostly decorticated, so no full description can be given. Sufficient of the test remains to show that there was no radial ornamentation, and the outline is quite different from that of *L. retiaria* (Hutton) or *L. simplex* Marwick in that the beaks are narrower and higher and the posterior end is much higher.

Genus MACTRA Linné, 1758.

Type: *M. stultorum* Linné.**Mactra rudis** Hutton.1873. *Macra rudis* Hutton, *Cat. Tert. Moll.*, p. 19.1893. *Standella rudis* Hutton, *Macleay Memm.* vol. p. 77, pl. 8, figs. 83 a, b.1913. *Macra rudis* Hutton: Suter, *Man. N.Z. Moll.*, p. 967.

Locality: Titirangi

A single right valve was found.

Genus SCALPOMACTRA Finlay, 1926.

Type: *Mactra scalpellum* Reeve.**Scalpomactra scalpellum** Reeve.1854. *Mactra scalpellum* Reeve, *Conch. Ic.* vol. 8, pl. 19, fig. 106.1913. *Mactra* (*Coelomactra*) *scalpellum* Reeve: Suter, *Man. N.Z. Moll.*, p. 963, pl. 63, fig. 14.

Locality: Titirangi. Fragments.

Genus DOSINIA Scopoli, 1777.

Type: *A. africana* Hanley.(1) Subgenus *Phacosoma* Jukes-Browne, 1912.Type: *D. japonica* Reeve.**Dosinia (Phacosoma) wanganuiensis** Marwick.1927. *Dosinia* (*Phacosoma*) *wanganuiensis* Marwick, *Trans. N.Z. Inst.*, vol. 57, p. 586, figs. 24, 29, 30.

Locality: Titirangi.

(2) Subgenus *Kereia* Marwick, 1927.Type: *D. greyi* Zittel.**Dosinia (Kereia) chathamensis** n. sp. (Figs. 66, 67, 71.)

Shell circular, moderately inflated, beaks low. Lunule rather small, not impressed, bounded by incised line; escutcheon absent. Sculpture of close, bevelled, low concentric ridges, about 0.8 mm. wide, much narrower on posterior area, where some disappear altogether. Left hinge with long, strong, curved, posterior cardinal soldered to nymph without groove; strong median cardinal deeply and unequally grooved; long narrow, arcuate, entire, anterior cardinal; and low, narrow elongated anterior lateral. Right hinge with broad well-grooved posterior cardinal; triangular, short, grooved median; small, narrow, anterior cardinal; anterior lateral pit shallow with weak laterals, lower side grooved. Pallial sinus obscured but probably long, narrow, ascending. Valve-margins smooth.

Height 29 mm.; length 31.5 mm.; thickness (1 valve) 7.5 mm.; paratype 34 x 36 x 10.

Locality: Whenuataru Peninsula, Chatham Island.

Genus PARADIONE Dall., 1909.

Type: *Cytherea ovalina* Lamarck.

Subgenus *Notocallista* Iredale, 1924.

Type: *Cytherea kingi* Gray.

Paradione (*Notocallista*) *multistriata* (Sowerby).

1851. *Cytherea* (*Callista*) *multistriata* Sowerby, *Thes. Conch.* 2, p. 628; pl. 136, fig. 177.

1913. *Macrocallista multistriata* (Sowerby): Suter, *Manual N.Z. Moll.*, p. 982, pl. 62, figs. 3, a.

Three imperfectly preserved specimens, all left valves, are provisionally identified with the New Zealand Recent shell. One specimen is 40.5 mm. long, and is covered with well-marked, fine striae. It is longitudinally elongated and agrees in shape with specimens from Landguard Bluff, Wanganui, but is considerably larger. The other two specimens are relatively shorter, higher and more inflated, with a rather heavy shell. The outer surface is worn almost smooth except for strong growth-stages.

Possibly we have here two different forms which are worth separating from *multistriata*, but the material at hand is insufficient for accurate differentiation.

Locality: Titirangi.

Genus BASSINARIA nov.

Type: *Bassinaria macclurgii* Marwick.

Shell large, oval, strong. Lunule double, both parts bounded by linear depression, no escutcheon. Sculpture of irregular concentric growth-ridges, and indications of lamellae distally. Hinge of right valve the same as that of *Bassina*, except that in front of the anterior cardinal is a deep lateral pit. No left valve was found, but evidently it has a strong anterior tubercle. The nymphs are narrow and much more deeply sunken than in *Bassina*. Pallial sinus broadly linguiform, horizontal. Valve-margins weakly crenate.

***Bassinaria macclurgii* n. sp. (Figs. 73, 74.)**

Shell large, strong, oval, well inflated, with broad indistinct ridge bounding each side of narrow posterior area. Lunule double, lanceolate, not deeply sunken, bounded by shallow groove and with another central groove also shallow; escutcheon absent from right valve. Surface with numerous irregular growth-ridges, occasionally rising into short lamellae on posterior and anterior areas, the whole covered with fine, rather irregular concentric lines. Hinge strong; right valve with almost horizontal, grooved, moderately strong posterior cardinal, separated by a wide space from the fairly strong, grooved median cardinal which has parallel sides; anterior cardinal entire, almost parallel to but shorter than median; anterior lateral pit well marked but without laterals, extending as a narrow groove in front of anterior cardinal. Ligamental nymph narrow, deeply sunk, the side of ligamental pit divided longitudinally into two equal parts the lower one well impressed. Pallial sinus broad, linguiform, horizontal. Valve-margin finely crenate.

Height 65 mm.; length 56 mm.; thickness (1 valve) 18 mm.

Locality: Titirangi.

Only a single right valve was found. The cardinal teeth, the pallial sinus, the sculpture, and the lunule all agree well with *Bassina*, but the anterior lateral pit is a new feature and worth systematic recognition. The pit in the right valve is on a groove situated in front of the anterior cardinal, it therefore has had a different origin from that of *Macrocallista*, *Paradione* etc. (Marwick, 1927, p. 598).

Genus TAWERA Marwick, 1927.

Type: *Venus spissa* Quoy and Gaimard.

Tawera marshalli Marwick.

1927. *Tawera marshalli* Marwick, *Trans. N.Z. Inst.*, vol. 57, p. 614, figs. 131-3, 135, 136.

The Chatham Island specimens are smaller than the typical *T. marshalli* and are inclined to have a shorter posterior dorsal margin.

Localities: Flower-pot Harbour, Pitt Island; Whenuataru Peninsula, Pitt Island.

Tawera marthae n. sp. (Figs. 72, 75, 76.)

Shell relatively large and strong, suboval to subcircular, well inflated. Beaks behind anterior third. Anterior end broadly rounded, posterior end narrower, dorsal margin high. Lunule large, lanceolate, bounded by an incised line; escutcheon slightly flattened, not sunken. Sculpture of bevelled concentric ribs generally 9 or 10 per cm., but sometimes as many as 15; ribs die away on posterior third of shell which is obsoletely concentrically grooved; some specimens show weak radials corresponding to the marginal crenulations; in others the whole surface shows only obsolete concentric sculpture; in a few the strong concentric sculpture persists to posterior dorsal margin. Hinge rather weak except in old individuals; teeth strongly diverging. Right valve with a lamellar anterior cardinal, strong bifid median and somewhat weaker bifid posterior cardinal; nymph narrow fairly well sunk below dorsal margin. Left valve with narrow cardinals, the median bifid. Pallial sinus short, ascending, apex rounded. Valve margin finely crenate.

Height 32 mm.; length 35 mm.; thickness (1 valve) 10 mm.

Locality: Titirangi, plentiful.

Genus PAPHIRUS Finlay, 1926.

Type: *V. largillierti* Philippi.

Paphirus largillierti Philippi.

1835. *Venus intermedia* Quoy and Gaimard, *Voy. Astrol.*, vol. 3, p. 526, pl. 84, figs. 9, 10, not of de Serres.

1849. *Venus largillierti* Philippi, *Zeitsch. F. Malak.*, p. 87.

1913. *Paphia intermedia* Q. and G.: Suter, *Man. N.Z. Moll.*, p. 995, pl. 61, figs. 6, a.

Locality: Titirangi, plentiful.

Finlay (1926, p. 471) was not able to give the reference for the first use of *Venus intermedia*. In Bronn's *Index Palaeontologicus* this is credited to M. de Serres, *Géognosie des terrains tertiaires*, 264, 272, t. 6, f. 8: Paris, 1829.

Genus EUMARCIA Iredale, 1924.

Type: *Venus fumigata* Sowerby.

Eumarcia plana Marwick. (Figs. 77, 81, 83.)

1927. *Eumarcia plana* Marwick, *Trans. N.Z. Inst.*, vol. 57, p. 627, figs. 207, 210.

Locality: Titirangi.

Many specimens of this fine large shell were collected from the lowest four feet of the shell bed at Titirangi. In New Zealand *E. plana* occurs in the lower part of the Nukumaruan and in the Waitotaran.

Genus GARI Schumacher, 1817.

Type: *Tellina gari* Linné.

Gari stangeri (Gray).

1843. *Psammobia stangeri* Gray, Dieffenbach *N.Z.* p. 253.

1913. *Psammobia stangeri* Gray: Suter, *Man. N.Z. Moll.*, p. 1003, pl. 61, figs. 9, a.

Locality: Titirangi.

Many large specimens of this species can be collected.

Genus NEMOCARDIUM Meek, 1876.

Type: *Cardium semiasperum* Deshayes.

Nemocardium diversum n. sp. (Fig. 85.)

Shell subcircular, inflated, beaks prominent; anterior end regularly convex, posterior broadly almost vertically truncated. Sculpture: about 25 closely placed ribs on posterior area, the upper ones somewhat scattered; rest of disc almost smooth, with about 75 ribs indicated only by shallow bounding lines. Valve-margin crenate throughout.

Height 23.5 mm.; length 25 mm.; thickness (1 valve) 10 mm.

Localities: Cliffs below Wireless Station, Waitangi; Whenuataru Peninsula, Pitt Island.

The specimens from the latter place are mostly decorticated, and so their identification is not certain.

Genus CORBULA Lamarck, 1801.

Type: *C. sulcata* Lamk.

Corbula howesi n. sp. (Figs. 79, 80, 82.)

Closely allied to *C. zelandica* Q. and G., but differing in the anterior dorsal margin being straighter and more steeply inclined producing a narrowly-rounded anterior end. The shell is more heavily built than the Recent species, but the sculpture is practically the same, there being considerable variations in the strength of the concentric ridges. The hinge-plate is much stronger in *C. howesi*, and in the right valve the conical tooth is larger but does not project below the hinge-plate as in *C. zelandica*. In front of the tooth in *C. zelandica* the hinge-plate narrows and almost disappears, but in *C. howesi* it is quite wide and continues round towards the anterior adductor. The tooth of *C. zelandica* is generally well inclined but that of *C. howesi* is more vertical. There are corresponding differences between the left valves. Viewed from above the notch for the

reception of the cardinal tooth is narrower in *C. howesi* and the denticle behind the ligamental area is not so distant.

Height 8.5 mm.; length 14 mm.

Localities: Flower-pot; Whenuataru Peninsula.

***Corbula tophina* n. sp. (Fig. 78.)**

Shell small, moderately inflated, valves slightly unequal; beaks broad, about anterior third; anterior end narrowly convex; posterior end broadly, obliquely truncated, an angular ridge extends from the umbo to bluntly pointed lower extremity of posterior margin; posterior area concave. Sculpture of weak, rounded, concentric ridges with linear interstices, four or even five per mm. Hinge of right valve with strong conical cardinal tooth immediately below umbo, and very large ligamental gap behind it.

Height 6.75 mm.; length 9 mm.; thickness (right valve) 3 mm.

Locality: Cliffs below Wireless Station, Waitangi.

Remarks: Not closely related to any New Zealand species.

Genus *BARNEA* Risso, 1826.

Type: *B. spinosa* Risso.

***Barnea similis* (Gray).**

1835. *Pholas similis* Gray, Yate *N.Z.*, p. 309.

1913. *Barnea similis* Gray: Suter, *Man. N.Z. Moll.*, p. 1017, pl. 61, figs. 11, a.

Locality: Titirangi, fragment only.

b. CLASS *GASTEROPODA*.

Genus *ATALACMEA* Iredale, 1915.

Type: *Patella unguis-almae* Lesson.

***Atalacmea elata* n. sp. (Figs. 97, 98.)**

Shell small, conic, fairly strong, apex about anterior eighth. Sculpture of 9 shallow, waved, concentric furrows each still marked by a dark pigment; whole surface crowded by extremely fine radial lines. Muscular impression broad, well marked, with a wide anterior interruption.

Length 4 mm.; breadth 2.8 mm.; height 1.5 mm.

Locality: Titirangi.

Distinguished from the Recent *A. fragilis* (Sowerby) by the greater relative height and the smoother radial ribs.

Genus *EMARGINULA* Lamarck, 1801.

Type: *Patella fissura* Linné.

***Emarginula pittensis* n. sp. (Fig. 100.)**

Shell rather small, ovato conic, elevation variable, apex recurved at posterior fourth. Sculpture of about 27 or 29 primary radial cords with a weaker one appearing in most of the interstices, these are reticulated by spaced concentric cords, the intersections of the two systems being nodular. Valve-margin strongly crenate. Deep, narrow, anterior notch, situated on a slightly-flattened anterior area, and having sides not raised so high as primary ribs.

Height 4 mm.; length 9 mm.; breadth 6 mm.; notch 2 mm. deep.

Locality: Flower-pot Harbour, Pitt Island.

Remarks: The sculpture is much coarser and the shape more oval than that of *E. striatula* Q. and G.

Emarginula galeriformis n. sp. (Fig. 104.)

Shell similar in size and general shape to *E. pittensis*. Sculpture of about 28 strong axial ribs with a weak secondary in only a few of the interspaces. These are crossed by regularly-spaced concentric ribs which make the axials nodulous. The interspaces have a pitted appearance, and give the sculpture a distinctive look. The anterior notch is narrow and is bounded by two strong, sharp ridges much higher than the primary ribs. The anterior end of the shell is regularly convex and not at all flattened.

Height 5.25 mm.; length 8.5 mm.; breadth 6 mm.; notch 2 mm. deep.

Locality: Whenuataru Peninsula.

Genus *TUGALIA* Gray 1843 (em.).

Type: *Tugalia elegans* Gray.

Tugalia aranea n. sp. (Fig. 101.)

Sculpture of about 25 strong primary radials separated by rather wide interspaces in each of which there is generally a weaker secondary radial. These are crossed by high, narrow, well-spaced concentric ridges which render the radials strongly nodulous at points of intersection. The anterior sinus rib divides into three parts. Valve-margin crenate.

Height 7 mm.; length 17 mm.; width 12 mm.

Locality: Flower-pot Harbour, Pitt Island.

Distinguished from *T. elegans* Gray and *T. colvillensis* Finlay by the stronger sculpture and more spaced and fewer ribs.

Finlay (1926, p. 344) advocated the use of Gray's original spelling *Tugali*. There are several misprints in neighbouring pages of Dieffenbach's book, and Gray himself made the correction to *Tugalia* which has been in general use ever since. Correction of misspellings or misprints is in accord with the International Rules, consequently the amended form is used above. Finlay's page references to Dieffenbach incorrectly follow Iredale's of 1915, also the page reference to Iredale has escaped correction. The reference to Dieffenbach should be page 240 not 259, and to Iredale, 1915 B p. 434. These are small matters and practically impossible to avoid in a long paper, but the correction comes aptly under this heading.

Genus *PEROTROCHUS* Fischer, 1885.

Type: *Pleurotomaria quoyana* Fischer and Bernardi.

Perotrochus allani n. sp. (Figs. 110, 114.)

Shell large, conical, imperforate. Spire slightly less than $1\frac{1}{2}$ times height of aperture, whorls 8 remaining, apex broken; spire-whorls convex, body roundly angled; base slightly convex. Suture lightly impressed. Sculpture: above slit, 5 weak spiral cords with a

still weaker one in interstices; below, about 8 stronger spiral cords with slightly wider interstices. On upper whorls there are no interstitial threads and number of primaries is reduced on these whorls; also, strong oblique axial growth-lines intersect the three upper spirals rendering them moniliform. Base of body-whorl weaker and with closer spirals than the sides, becoming obsolete towards centre, only about outer 16 being visible. Aperture rhomboid; outer lip with narrow slit about middle, making a spiral fasciole ascending shell, above slit, lip slopes obliquely forward to suture, below it is almost vertical. Columella, slightly arcuate below, thickened above and strongly twisted to form deep notch like *Trochus* before joining the parietal wall. Basal margin slightly convex, sinuous when viewed from below.

Height 57 mm.; diameter 66 mm.

Locality: Waikaripi, below Wireless Station, Waitangi.

There is no true umbilicus, but the central part of the base at the insertion of the columella is somewhat sunken.

Genus *MARGARELLA* Thiele.

Type *Margarita violacea* Sowerby.

***Margarella runcinata* n. sp. (Fig. 99.)**

Shell small, turbinate, imperforate, spire two-thirds height of aperture. Whorls five, convex. Protoconch small, broadly tectiform, not definitely limited. Suture slightly appressed. Surface smooth and polished except for a few obsolete spiral threads on base and on some of spire-whorls; also with very fine growth-lines. Aperture circular, entire. Outer lip thin, straight, inclined 45° from vertical. Columella smooth, concave, with a layer of callus extending a short way over slightly concave base.

Height 6 mm.; diameter 7.5 mm.

Locality: Cliffs below Wireless Station, Waitangi.

Distinguished from *M. decepta* (Iredale) by spirals being altogether absent from most of the surface; also by the less expanding and not descending body-whorl. The callus on the inner lip is smooth and flat, not hollowed in the umbilical region, and there is no inclination towards effuseness of the aperture.

Genus *MICRELENCHUS* Finlay, 1926.

Type: *Trochus sanguineus* Gray.

***Micrelenchus rufozona* (A. Adams).**

1853. *Cantharidus rufozona* A. Adams: *Proc. Zool. Soc.* (1851) p. 170.

1913. *Cantharidus rufozona* A. Ad.: Suter, *Man. N.Z. Moll.*, p. 127, pl. 35, fig. 16.

1926. *Micrelenchus rufozonus* A. Ad.: Finlay, *Trans. N.Z. Inst.*, vol. 57, p. 370.

Locality: Titirangi (common).

Many of the specimens have a broader spire and narrower spiral interspaces than the Recent shells, but others are quite typical.

Genus *ZEMINOLIA* Finlay, 1926.Type: *Minolia plicatula* Murdoch and Suter.***Zeminolia lenis* n. sp.** (Figs. 102, 103.)

Shell small, conic. Protoconch of less than two smooth whorls with a large bulbous nucleus. Whorls three, convex on spire, body-whorl with rounded periphery and sloping base. Suture bordered below by a fairly wide, flat, or slightly concave *rampe*. Sculpture: penultimate whorl with 8 weak, narrow, spiral ribs; on body-whorl the spirals are obsolete and difficult to count, but there are about 18 altogether, including the base. A moniliform cord bounds the umbilicus, which is widely open. Columella slightly concave.

Height 3 mm.; diameter 3.5 mm.

Locality: Whenuataru Peninsula.

Genus *MAUREA* Oliver, 1926.Type: *Trochus tigris* Martyn.***Maurea finlayi* n. sp.** (Fig. 105.)

Shell rather small, conical, imperforate. Spire twice as high as aperture. Whorls, five remaining on holotype, but about five including protoconch have been broken from apex of it; body-whorl slightly convex, with a rounded periphery, base slightly convex. Protoconch small, globular, of about one smooth whorl. First conch-whorl with two weak spirals which become strong on second whorl and are crossed by about 16 sharp, spaced axials, forming sharp nodules at intersection of spirals. A weak spiral thread appears on shoulder of third whorl becoming stronger on fourth, a weak thread appearing in the other spiral interspaces; fifth whorl with six spirals of about equal strength, crossed as on previous whorls by sharp axials; sixth whorl with 9 spirals upper three stronger and more widely spaced than lower ones; axials have now ceased to cross all but top two interspaces. On later whorls this condition holds, the spirals on penultimate whorl numbering nine with spiral thread in some interstices. Body-whorl with about fourteen subequal spirals on side and seventeen on base, interstices somewhat narrower and with interstitial thread on those near columella, posterior three spirals are rather strongly beaded, the others weakly so, almost smooth. Aperture rhomboid, outer lip inclined. Columella smooth, twisted.

Height 17 mm.; diameter 13 mm.

Locality: Flower-pot Harbour, Pitt Island.

Finlay's *Venustus* is founded on the same type as *Maurea* but was published several days later.

Genus *ARGALISTA* Iredale, 1915.Type: *Cyclostrema fluctuata* Hutton.***Argalista effusa* n. sp.** (Fig. 107.)

Shell small, turbinate, umbilicate. Spire low; whorls 4 including protoconch, convex; base flattened. Sculpture of low closely-placed spiral threads, penultimate whorl with 8 increasing to 12; about 26 on the body-whorl including base, where spirals are about half width of the others. Suture slightly impressed. Aperture circular effuse at base of columella, outer lip straight, thin. Columella

concave, thickened below by effusion of aperture. Umbilicus deep, circular.

Height 2.4 mm.; diameter 2.8 mm.

Locality: Flower-pot Harbour, Pitt Island.

***Argalista arta* n. sp. (Fig. 106.)**

Shell small, turbate, almost imperforate. Spire low; whorls five including protoconch, convex; base flattened. Sculpture of low spiral threads with linear interstices; penultimate whorl with eight spirals, increasing to 16 just above the aperture because of the rapidly-descending body-whorl, about 26 spirals on the body including base. Suture slightly impressed. Aperture circular, entire; outer lip straight, edge thin, thickening within. Columella concave, calloused, bounded on the outside by a shallow depression in which the umbilicus appears as an almost closed slit.

Height 2.5 mm.; diameter 2.75 mm.

Locality: Flower-pot Harbour, Pitt Island.

Genus RANGIMATA nov.

(Named after one of the first Polynesian canoes to reach the Chathams)

Type: *Rangimata pervia* Marwick.

***Rangimata pervia* n. sp. (Figs. 112, 113.)**

Shell very small, depressed turbate. Protoconch of two smooth planorbid whorls with large nucleus. Post-embryonic whorls about one and a half, body-whorl rather flattened, depressed near suture. Suture impressed, descending near aperture. Sculpture of from 8-12 close spiral threads on the penultimate whorl; body-whorl with about 45. These spirals are rather sharp and are finely moniliform owing to the numerous growth-lines which are stronger on base. Aperture subcircular, inclined at about 45°, outer lip thin, straight. Inner lip with a large semilunar umbilicus which penetrates nearly to apex and in which earlier whorls can be seen.

Height 2 mm.; diameter 2.6 mm.

Locality: Titirangi, a single specimen.

The umbilicus, being situated well within the aperture, is quite different from the usual type which is formed between the inner margin of the aperture and the base of the shell. Certain of the Turbinidae develop a somewhat similar umbilicus.

Genus IMPERATOR Montfort, 1810.

Type: *Trochus heliotropium* Martyn.

***Imperator anthropophagus* n. sp. (Fig. 127.)**

Shell similar in size and shape to *I. heliotropium* (Martyn). Sculpture: penultimate whorl with about 6 and body-whorl with about 9 principal moniliform spirals, gradually descending on the whorl and some running out into the spines. In each interstice between the larger spirals is generally a weak, moniliform thread. The whole surface is traversed by oblique growth-lines, which, however, do not form scales on the spirals as in *I. heliotropium*.

Height 40 mm.; diameter (about) 60 mm.

Locality: Flower-pot Harbour, Pitt Island.

Genus ZETHALIA Finlay, 1926.

Type: *Umboonium zelandicum* A. Ad.

Zethalia zelandica A. Adams.

1854. *Umboonium zelandicum* A. Adams, *Proc. Zool. Soc.* (1853), p. 188.

1913. *Ethalia zelandica* Hombron and Jacquinot: Suter, *Man. N.Z. Moll.*, p. 170, pl. 39, figs. 9, 9a.

Locality: Titirangi, a single fragment.

Genus ESTEA Iredale, 1915.

Type: *Rissoa zosterophila* Webster.

Estea insulana n. sp. (Fig. 115.)

Shell minute, pupoid, spire about three times as high as aperture. Protoconch conoid of two smooth whorls with a large nucleus. Post-embryonic whorls about $3\frac{1}{2}$, slightly convex, flattened on upper half of each whorl; body-whorl regularly curved not much inflated. Suture well marked, faintly bordered below. Surface smooth except for some weak, microscopic growth-lines. Aperture ovate, angled above. Outer lip sharp, thickened within, lightly sinuous. Peristome continuous, somewhat thin on parietal wall.

Height 2.5 mm.; diameter 1.1 mm.

Locality: Titirangi.

Estea subtilicosta n. sp. (Fig. 116.)

Shell minute, subulate spire about three times as high as aperture. Protoconch conoid, of one and a half smooth whorls with a large nucleus. Post-embryonic whorls slightly over 4, flattened, slightly convex below; body-whorl regularly curved, not increasing in diameter until the last quarter turn. Suture well marked. Surface crowded with fine regular, oblique axial threads. Aperture oval. Outer lip sharp, thickened within, lightly sinuous. Peristome continuous, rather thick on inner side.

Height 3.2 mm.; diameter 1.2 mm.

Locality: Titirangi.

Genus MERELINA Iredale, 1915.

Type: *Rissoa cheilostoma* Ten.-Woods.

Merelina avita n. sp. (Fig. 111.)

Shell minute, turriculate, imperforate. Spire about twice as high as aperture. Whorls six, regularly increasing, biangulate, body-whorl occupying over one half the total height. Sculpture of two strong spiral ridges, dividing the whorl into three equal parts, reticulated by 13 sharp axial ribs, the intersections slightly nodular. Body-whorl with three additional, sharp, spaced spirals not crossed by the axials. Aperture broadly oval, oblique; peristome thick, continuous.

Height 3 mm.; diameter 1.3 mm.

Flower-pot Harbour, Pitt Island.

Remarks: This species is closely related to *M. lyalliana* Suter having the same arrangement of sculpture, but it differs in having a larger body-whorl and more rapidly tapering spire, also in lacking the double peristome.

Genus *RISSOINA* d'Orbigny, 1840.Type: *R. inca* d'Orb.***Rissoina chathamensis* Hutton.**1873. *Eulima chathamensis* Hutton, *Cat. Mar. Moll. N.Z.*, p. 23.

Locality: Whenuataru Peninsula.

Further specimens may justify separation from *R. chathamensis*, but the single specimen collected shows no important difference from the Recent shell.

Genus *ATAXOCERITHIUM* Tate, 1894.Type: *Cerithium serotinum* Adams.***Ataxocerithium simplex* n. sp. (Fig. 109.)**

Shell small, conic. Spire twice height of aperture, body-whorl sharply angled at periphery, base flat, contracting very quickly to short neck. Suture deep. Sculpture: first post-embryonic whorl with concave well spaced axial ribs, three spiral cords appear on second whorl, the lower two much stronger. These are crossed by strong straight axial ribs the junctions being nodulous. On later whorls the three spirals and the axials are of approximately equal strength so shell has regularly cancellate appearance. Axials number about 16 per whorl, interstices between spirals are narrower than cords. An additional weak spiral appears just below suture on last three whorls, and part of another is exposed in suture, but there are no secondaries in interspaces of primary spiral cords. Just below periphery, and emerging from suture is strong spiral cord and another is on base not far away from it. The upper rib marks termination of axial ribs but both are sinuous. Base and neck bear about six more very weak spirals. Aperture rhomboidal. Columella straight with weak fold bordering short canal which obliquely truncates it.

Height 9.25 mm.; diameter 5.25 mm.

Locality: Titirangi.

This species closely resembles *A. pyramidale* Finlay, but it is slightly larger and has no secondary spirals in the interstices of the three primaries.

Genus *NOTOSINISTER* Finlay, 1926.Type: *Triphora fascelina* Suter.***Notosinister insertus* n. sp. (Fig. 108.)**

Shell small, subulate, sinistral. Protoconch damaged. Post-embryonic whorls five, outlines straight, body-whorl keeled, base rapidly contracting to short canal. Suture deep. Sculpture on first three whorls of two moniliform spirals with narrow interspace which on later whorls becomes wider, interspace occupied by a narrow moniliform thread which towards aperture is almost as large as the original two. On body-whorl are 19 axials which form beads on spirals; base with two strong spirals narrowly separated and not crossed by the axials. Aperture oval, oblique, produced into a short canal obliquely truncating the columella, which is smooth.

Height 3.5 mm.; diameter 1.3 mm.

Locality: Flower-pot Harbour, Pitt Island.

Genus *TURRITELLA* Lamarck, 1799.

Type: *Turbo terebra* Linné.

Subgenus *Spirocolpus* Finlay, 1926.

Type: *Turritella waihaoensis* Marwick.

***Turritella solomoni* n. sp. (Fig. 117.)**

Shell large, strong, broad, apical angle 25° ; whorls only slightly more than half as high as broad. Suture deep. Sculpture of two very strong cinguli with a concave interspace. On early whorls both cinguli are rounded and of almost equal strength and there is a strong central spiral; later, the upper one becomes angled and not so strong as lower, and middle one disappears. The whole surface is covered with low, close spiral threads, one not far below suture being stronger than the others. Aperture subquadrate; outer lip with deep sinus, its apex slightly above median thread.

Height (estimated) 55 mm.; diameter 15 mm.

Localities: Whenuataru Peninsula (type); Flower-pot Harbour, Pitt Island.

The two strong cinguli give this shell some resemblance to *T. waihaoensis* Marw. and *T. tophina* Marw., but the apical angle is much wider, the spiral threads are wider where developed, and the apertural sinus is not so deep. The species is dedicated to Mr. T. Solomon "the last of the Morioris."

Genus *ZEGALERUS* Finlay, 1926.

Type: *Calyptraea tenuis* Gray.

***Zegalerus crater* Finlay.**

1885. *Trochita alta* Hutton, *Trans. N.Z. Inst.*, vol. 17, p. 329 (not of Conrad).

1893. *Calyptraea alta* Hutton, *Macleay Mem. Vol.*, p. 62, pl. 7, fig. 59.

1906. *Calyptraea alta* Hutton, Suter, *Trans. N.Z. Inst.*, vol. 38, p. 326.

1913. *Calyptraea alta* Hutton, Suter, *Man. N.Z. Moll.*, p. 284, pl. 44, fig. 2.

1926. *Zegalerus crater* Finlay, *Trans. N.Z. Inst.*, vol. 57, p. 392.

Locality: Titirangi (common).

Genus *COCHLIS* Bolten, 1798.

Type: *Cochlis albula* Bolten.

***Cochlis notocenica* (Finlay)**

1924. *Natica notocenica* Finlay, *Trans. N.Z. Inst.*, vol. 55, p. 450, pl. 49, figs. 2a, b, c, d.

Locality: Whenuataru Peninsula, Pitt Island.

A single specimen with a rather lower spire than usual in this species.

Cochlis n. sp. cf. *australis* (Hutton).

1878. *Lunatia australis* Hutton, *Journ. d. Conch.*, vol. 26, p. 23.

1913. *Natica australis* Hutton: Suter, *Man. N.Z. Moll.*, p. 289, pl. 15, fig. 16.

1924. *Natica maoria* Finlay, *Proc. Malac. Soc.*, vol. 16, p. 101.

1924. *Natica maoria* Finlay: Marwick, *Trans. N.Z. Inst.*, vol. 55, p. 552, pl. 55, figs. 16, 18.

Locality: Whenuataru Peninsula, Pitt Island.

Two fragmentary specimens not good enough for description. These shells have a large nucleus like that of *C. australis* and the umbilicus has no funicle, thus resembling some forms of that species.

Cochlis pittensis n. sp. (Fig. 125.)

Shell of moderate size, globose. Spire four-fifths height of aperture. Whorls 6 including protoconch which has small nucleus. Suture appressed. Surface smooth. Aperture bluntly ovate; outer lip straight, inclined 30° from vertical, slightly retracted to suture. Inner lip with thin callus on parietal wall. Umbilicus completely filled by large semicircular funicle.

Height 17 mm.; diameter 16 mm.

Localities: Flower-pot Harbour, Pitt Island (type); Whenuataru Peninsula.

Remarks: No New Zealand species has the umbilicus completely filled by the funicle, the Recent and Pliocene *C. zelandica* most nearly approaching this condition.

Genus **GLOBISINUM** Marwick, 1924.

Type: *Sigaretus drewi* Murdoch.

Globisinum mucronatum n. sp. (Fig. 121.)

Shell globose, spire relatively prominent, about one-fourth height of aperture. Protoconch of about two and a half smooth whorls which stand well above the following whorls. Sculpture of some obsolete, waved lirae, mostly developed near the suture and on the base. Aperture large; outer lip antecurrent to suture. Inner margin sinuous. No umbilicus.

Height 14.5 mm.; diameter 13.5 mm.

Locality: Whenuataru Peninsula, Pitt Island.

Closely related to *G. wollastoni* Finlay (= *undulatum* Hutton) but easily distinguished by the much larger protoconch; also the sculpture is almost absent.

Genus **KOROVINA** Iredale, 1918.

Type: *Vanikoro wallacei* Iredale.

Korovina accelerans n. sp. (Fig. 122.)

Shell small and fragile. Spire one-third height of aperture and canal. Protoconch bulbous, smooth of about one and a half turns with a large nucleus. Whorls a little over two, convex on the spire; body-whorl greatly expanded. Suture impressed. Sculpture of sharp oblique axial ribs separated by wider interspaces, about 20 high ones on the penultimate whorl but a great many more finer ones on the

body-whorl, of which only about the first fifth has the coarse sculpture. Aperture semilunar, entire. Outer lip slightly concave, inclined about 45° from vertical. Umbilicus very wide, bounded by a well-defined ridge and with radiating costae which traverse the ridge obliquely but do not continue on to the body.

Height 3.5 mm.; diameter 3.5 mm.

Locality: Whenuataru Peninsula, Pitt Island.

Genus TRIVIA Broderip, 1837.

Type: *Cyprea monacha* Da Costa (= *C. europea* Mont.).

Trivia flora n. sp. (Figs. 118, 119.)

Shell small, ovate, inflated, dorsum smooth somewhat conoid, spire concealed, showing only a small tubercle; sculpture of transverse sharp ridges with much wider concave interstices, about 21 on the outer lip and 16 on the inner, die out almost as soon as they pass from the front of the shell. Only one rib, the 4th from top on outer lip fails to reach the aperture, while the 8th from below on the inner margin on inner lip does not reach the exterior; aperture narrow, widening slightly below, curved to the left above, outer lip rounded, expanded beyond the sides of the whorl and raised above the apex; columella slightly concave above, deeper below, and expanded on the inner margin.

Height 10 mm.; diameters, left to right, 7.3 mm., front to back 6 mm.

Locality: Flower-pot Harbour, Pitt Island.

Remarks: Resembles *T. zealandica* Kirk from the Pliocene of Hawke's Bay, but is not so attenuated anteriorly, and its dorsum is not so regularly rounded, being bluntly conoid.

Genus PHALIUM Link, 1807.

Type: *Cassis glauca* Linné.

Subgenus *Kahua* nov.

(From Kahu the Polynesian discoverer of the Chatham Islands.)

Type: *Phalium skinneri* Marwick.

Shell subglobular, thick, sculpture of strong spiral and axial grooves dividing the surface of the body-whorl on a regularly chequered plan. Outer lip with a strong varix, regularly lirate within. Columella almost straight with six equal cords. Inner lip strongly lirate.

Among the divisions of *Phalium*, *Kahua* is perhaps most nearly related to *Semicassis* Morch, type *Buccinum saburon* Lamk. from which it differs in having strong axial sculpture and much stronger spiral sculpture. Also *Kahua* has many more folds on the columella and on the inner and outer lips; the canal is not so sharply twisted; and the anterior notch is shallower.

Phalium (Kahua) skinneri n. sp. (Fig. 132.)

Shell thick and strong; spire less than one-third height of aperture. Protoconch tectiform of about four smooth whorls with small nucleus. Post-embryonic whorls four, slightly convex on spire.

Suture impressed. Sculpture: first whorl with two obsolete cords towards top of whorl; second with an additional thread near suture, all crossed by strong growth lines, on later whorls many additional spirals appear but the three primaries can be traced on body though upper is divided into 4, middle into 2, and lower into 2; interstices with additional threads (top one with 4, one stronger), below the third cingulum are 20 strong, broad spiral cords, with narrower interstices, some of the top ones being double. The spirals are regularly cancelled by strong bevelled ridges. Aperture deeply notched below; fasciole indistinctly spirally striated. Outer lip reflexed and much thickened to form strong varix, dentate within. Inner lip thickened, practically filling umbilicus but with no projecting platform; bearing about 16 waved threads of which 6 are on columella.

Height 41 mm.; diameter 31 mm.

Locality: Whenuataru Peninsula, Pitt Island.

Genus *CIRSOTREMA* Morch, 1852.

Type: *Scalaria varicosa* Lamk.

***Cirsotrema chathamense* n. sp. (Fig. 120.)**

Shell of moderate size, turreted, imperforate, whorls convex, body keeled. Suture deep. Sculpture of 16 rather sharp, strong axials with irregular edges, in interstices and on back of axials are 6 spiral threads with about 4 weaker threads in the wide interspaces, axials weakly crested below suture. Base keeled and with fine spirals in the rib-interstices. The anterior of the shell is broken, but there was apparently a strong basal fasciole.

Height (estimated) 22 mm.; diameter 8.5 mm.

Locality: Momoe-a-toa.

Remarks: This species resembles *C. zelebori* in general appearance, but the spiral sculpture is much finer, *C. lyratum* has a shallower suture and coarser sculpture.

***Cirsotrema parvulum* n. sp. (Fig. 124.)**

Shell small turreted, imperforate, whorls strongly convex, body keeled. Suture deep. Sculpture of 22-24 narrow axials with rather wider interstices, in which appear 8 or 10 spiral threads, the axials generally have a spur shortly below the suture, on the line of which proceeds a keel limiting the flat base on which the axials are weaker and spirals absent. Aperture circular, effuse on the columellar side and forming a small fasciole; basal margin straight, angled at junction with columella.

Height (estimated) 10 mm.; diameter 4 mm.

Locality: Momoe-a-toa.

***Cirsotrema propelyratum* n. sp. (Fig. 123.)**

Shell strong, imperforate, whorls convex, sutures moderately deep. Sculpture of 12 strong, high, roughly edged varices per whorl, narrower than the interstices and slightly crested below suture. Each whorl has about seven low primary spirals, the upper and lower two even weaker than the others; the interspaces between spirals are broadly concave, so there is no dividing line between spiral and inter-

space. The interspaces have generally four secondary spiral threads, the inner two being stronger than the outer ones which are sometimes absent. The spirals rise up to the top of the axial varices on their posterior side, but on the crest and anterior side the axials are roughly lamellar. The spirals cross these lamellae and are marked by very weak spines. At the line of suture, the body-whorl has a strong keel, and the axials are expanded on crossing it. Aperture subcircular not effuse, but with a wide fasciole on the basal side, anterior outer margin straight, forming the flattened base.

Height (estimated) 35 mm.; diameter 12 mm.

Locality: Bryozoan limestone, Flower-pot.

Closely resembling *C. lyratum* Zittel but distinguished by fewer and much less spiny axials, deeper suture, and much stronger basal keel.

Subgenus *Tioria* nov.

Type: *Cirsotrema youngi* Marwick.

***Cirsotrema (Tioria) youngi* n. sp. (Fig. 128.)**

Shell of moderate size, turreted; whorls convex with a strong shoulder. Suture deep. Sculpture of 24 narrow high erect axial ribs on the body-whorl of type, 21 on penultimate, 18 on penepenultimate. A paratype has 28 on body and 25 on penultimate whorl. The ribs have strong posterior spine, but otherwise, except at keel, are smooth. Between spire and suture rib is concave and as interspaces are narrow the shell appears to have prominent, concave, infrasutural shoulder. The body-whorl has well marked base formed by forward overlapping of axial ribs, a weak bounding keel is present in interstices. Rib-interspaces and back of ribs both on the sides and base are crowded with fine regular spiral threads with linear interstices, becoming extremely fine posteriorly. Basal fasciole strong in youth, bounding a narrow umbilicus which is not present in adult. Aperture circular, entire, effuse posteriorly to form a spine, also diametrically opposite to form the basal fasciole. Basal outer margin is straight, but at its outer end is twisted in a peculiar manner so that the resulting rib is lapped over and flattened.

Height (estimated) 25 mm.; diameter 13 mm.

Diameter of a paratype 16 mm.

Locality: Bryozoan limestone, Tioriori.

This shell has no known close relatives, so the subgenus *Tioria* has been set up for it. *Tioria* is characterized by the peculiarly turned-over basal ribs, by the absence of strong spirals on the body which is almost regularly convex except that the shoulder is greatly emphasised by a strong spine on each rib. A keel is formed by the over folding of the ribs on the base, but neither it nor the shoulder is defined by a cord.

Genus *ODOSTOMIA* Fleming, 1813.

Type: *Turbo plicatus* Montagu.

***Odostomia pittensis* n. sp. (Fig. 126.)**

Shell small ovato-conic. Protoconch involute. Whorls five, outline straight on spire; body-whorl forming two-thirds total height,

periphery obscurely angled, base convex. Suture deeply impressed, bordered below. Sculpture: only a projecting thread bordering the suture, otherwise there are no spirals to be seen even under a microscope. Somewhat regular growth-stages are plainly marked giving the appearance of obsolete ribbing. Columella with one strong fold behind which is an extremely narrow umbilicus.

Height 6 mm.; diameter 2.5 mm.

Locality: Whenuataru Peninsula.

Probably directly ancestral to *O. stygia* Suter from which it differs in having straight-sided spire whorls, and no spirals on the surface except the sutural border.

Genus AUSTROMITRA Finlay, 1926.

Type: *Columbella rubiginosa* Hutton.

Austromitra plicifera n. sp. (Fig. 129.)

Shell small, fusiform; spire gradate. Protoconch slightly bulbous of two smooth relatively large whorls. Post-embryonic whorls four, with well defined almost horizontal shoulder, body whorl contracting rather slowly to the short neck which has no fasciole. Sculpture of 25 to 30 low, rounded axial ribs per whorl, the ribs do not reach across shoulder and on later whorls scarcely as far as anterior suture; traces of obsolete spiral cords visible. Aperture long and rather narrow, contracting gradually above not notched below. Outer lip thin, simple, lightly ascending. Columella straight, with three strong folds.

Height 10 mm.; diameter 5.5 mm.

Locality: Whenuataru Peninsula.

Genus AUSTROSIPHO Cossmann, 1906.

Type: *Fusus roblini* Tenison Woods.

Subgenus *Verconella* Iredale, 1914.

Type: *Fusus dilatatus* Quoy and Gaimard.

Austrosipho (Verconella) asper n. sp. (Fig. 131.)

Shell large, fusiform; spire less than aperture and canal. Protoconch of three smooth globose whorls with a rather small nucleus. Post-embryonic whorls with a high, slightly concave, fairly broad shoulder. Sculpture of 10 strong, rounded axial ribs persisting from suture to suture, but slightly weaker on the concave shoulder; axials crossed on upper whorls by five strong close spiral cords on sides and two strong, then five weaker spirals on shoulder, these increase later to seven, three, and six respectively, and the interspaces between strong threads are each filled by one weaker secondary spiral.

Height 140 mm.; diameter 65 mm. (both estimated).

Localities: Flower-pot Harbour, Pitt Island; Whenuataru Peninsula.

The axial sculpture is so much stronger than that of *A. adusta* (Philippi) that the species ought to be easily recognized.

Genus *ELLICEA* Finlay, 1928.

Type: *Siphonalia orbita* Suter.

Subgenus *Pittella* nov.

Type: *Pittella valida* Marwick.

Shell fusiform, thick and strong with concave shoulder. Protoconch tectiform, of two smooth whorls with rather large nucleus. Sculpture of rounded axial ribs crossed by strong, spaced spiral cords. Aperture broadly oval, well channelled above, produced below into a long, oblique scarcely twisted canal not notched at the end. Outer lip thick and lightly sinused at shoulder, thin and crenulated below, lirate within. Inner lip thin above, not concealing spirals which enter aperture, bearing several denticles below and a well marked one above.

Ellicea valida differs from *E. orbita* especially in its strong axial ribs and concave shoulder. The aperture is much wider posteriorly, because of the shoulder, and there is a strong, entering, spiral cord on the parietal wall.

***Ellicea (Pittella) valida* n. sp.** (Fig. 130.)

Sculpture of about 14 strong, somewhat narrowly-rounded axial ribs, weak or absent on the shoulder and not advancing far down the body-whorl. These are crossed by strong spiral cords with wider, flat interspaces, 3 on first whorls, 4 to 5 on penultimate, 12 on body and about 8 finer ones anteriorly on neck. An additional spiral traverses the middle of the shoulder, very weak at first but fairly strong on the body. The whole surface is covered with strong, dense growth-lines.

Height 37 mm.; diameter 21 mm.

Locality: Whenuataru Peninsula, Pitt Island.

Genus *COMINELLA* Gray, 1850.

Type: *Buccinum testudineum* Quoy and Gaimard.

Subgenus *Eucominia* Finlay, 1926.

Type: *Buccinum nassoides* Reeve.

***Cominella (Eucominia) bauckei* n. sp.** (Fig. 133.)

Shell strong, spire somewhat higher than aperture. Protoconch large, tectiform, of 3 smooth whorls with small nucleus. Post-embryonic whorls nearly 6, early ones strongly shouldered, but later ones only weakly so. Suture undulating, very little impressed. Sculpture of strong axial ribs with fairly wide interstices, 10 on early whorls increasing to 14 on body of type but becoming obsolete on a paratype. Ribs persist from suture to suture but die out quickly on base, they are crossed by spaced, obsolete threads, 4 or 5 on spire-whorls, too weak to be counted on body. Outer lip thin, smooth. Inner lip fairly thick, forming well defined pad. Fasciole well defined, obscurely spirally striated.

Height 32 mm.; diameter 15 mm.

Locality: Whenuataru Peninsula, Pitt Island.

There is a well-defined fold at the base of the columella in young stages, but in the adult it is concealed by the thick inner lip. C.

bauckei is directly ancestral to and not far removed from *C. elegantula*. Finlay from the Upper Pliocene of Castlecliff.

This species is dedicated to Mr. William Baucke, a former resident of the Chathams, who was much interested in and had a wide knowledge of the geologic structure of the Islands.

***Cominella (Eucominia) ellisoni* n. sp. (Fig. 140.)**

Shell large, fusiform, solid, apex acute, almost or quite equal to aperture in height. Protoconch obtusely tectiform, of about 3 smooth whorls. Post-embryonic whorls six, obliquely angled slightly above middle; body-whorl plump, occupying two-thirds of total height; regularly contracting to the short, strongly-fascioled neck. Suture impressed, undulating. Sculpture: a broad cingulum borders the suture below, and occupies a large part of the sloping, slightly concave shoulder; the angle of this shoulder is formed by another cingulum which together with that bordering the suture is divided into blunt knobs by low broad axials with narrow interspaces, about 16 per whorl. There are broad weak spiral cords, about 6 from shoulder angle to suture below, and 20 on body, with 3 or 4 fine cords in the wide interstices, these fine cords appear on the shoulder but not the fasciole and are crossed by numerous irregular growth-lines. Aperture oval, channelled above with a short, twisted, widely-open canal obliquely truncating the columella, and very deeply notched. Outer lip thin, slightly sinused at the shoulder and broadly convex below, sometimes weakly crenate, and often with spaced lirae within. Columella slightly concave, obliquely truncated below. Inner lip with a thick callus crossing the fasciole and produced to the anterior of the shell in an acute angle.

Height 60 mm.; diameter 31 mm.

Locality: Titirangi.

Remarks: Related to *C. nassoides* (Reeve), but with much less developed axial sculpture.

Genus ZEATROPHON Finlay, 1926.

Type: *Fusus ambiguus* Philippi.

***Zeatrophon lassus* n. sp. (Fig. 143.)**

Shell small, fusiform, spire about equal to aperture and canal. Whorls six remaining, biangulate, with a sloping slightly convex shoulder; body-whorl somewhat inflated, contracted quickly on base. Sculpture of about 16 sharp axials per whorl, with wide interspaces, some are closed in front but others have a free edge. The axials are crossed by two spiral cords forming a cancellate sculpture, intersections being nodulous. Body-whorl with three additional strong spiral cords on base, and seven weaker ones on neck. Aperture oval, produced below into a long, twisted canal not notched at end but strongly recurved. The neck bears a spiny fasciole caused by periodic changes in this curvature at end of canal.

Height 12.5 mm.; diameter 5.5 mm.

Locality: Whenuataru Peninsula, Pitt Island.

Very like *Z. bonnetti* (Cossmann) but with much weaker sculpture and a sloping shoulder which gives the whorls a convex shape.

Zeatrophon mutabilis n. sp. (Figs. 145, 146, 148.)

Shell large, strong, fusiform. Spire conic about half height of aperture. Whorls about 5, generally convex; body-whorl much inflated occupying five-sixths of total height, base contracting to form a short twisted canal with a raised rounded ridge forming a fasciole. Suture plain. Sculpture generally of obscure broad spiral cords with narrow interstices, about 6 on the penultimate whorl and 20 on the body. This is the general type, but it grades into a shell with strong spirals, two on first whorls the upper marking a strong shoulder, others appear in interstices later, on spire-whorls these are crossed by sharp lamellate axials 12 or 13 per whorl, but there are never axials on the body. Aperture broadly ovate, produced below into an oblique, twisted canal truncating the columella and not notched at base. Outer lip straight, sharp, thickened and often lyrate within, antecurrent to suture, scarcely contracted to canal. Columella slightly concave, obliquely truncated below. Inner lip with thin callus sometimes with narrow chink between it and bounding ridge of fasciole.

Height 39 mm.; diameter 27 mm.

Locality: Titirangi.

This shell is closely related to *Z. ambiguus*; in fact young specimens can sometimes scarcely be distinguished. The canal of adult *Z. mutabilis* is always much shorter, the body-whorls more inflated, the axial sculpture is generally poorly developed.

Genus **ZEMITRELLA** Finlay, 1926.

Type: *Lachesis sulcata* Hutton.

Zemitrella choava (Reeve).

1859. *Columbella choava* Reeve, *Conch. Ic.* 11, pl. 37, fig. 239.

1913. *Mitrella choava* Reeve: Suter, *Man. N.Z. Moll.*, p. 431, pl. 19, fig. 13.

Locality: Titirangi, a single specimen, doubtfully identified.

Genus **WAIHAOIA** Marwick, 1926.

Type: *Waihaoia allani* Marwick.

Subgenus *Pachymelon* Marwick, 1926.

Type: *Waihaoia murchisoni* Marwick.

Waihaoia (Pachymelon) renwicki n. sp. (Fig. 147.)

Shell fairly large, thick, biconic. Spire about two-thirds aperture. Protoconch large, smooth, scaphelloid, of three whorls with a bluntly pointed apex. Whorls about five, almost flat-sided on spire, body-whorl regularly inflated; fasciole scarcely interrupting the regular curve of the shell. Sculpture of about 16 low narrow axial ribs with wide, concave interstices, these axials are developed only on spire-whorls, are obsolete on penultimate whorl and absent from body. Aperture with a shallow anterior notch. Outer lip straight, slightly ascending, rounded not expanded. Columella with four strong, well spaced plaits.

Height 66 mm. (est.); diameter 30 mm.

Localities: Whenuataru Peninsula; Flower-pot Harbour.

Distinguished from the New Zealand species of *Pachymelon* by the relatively high spire.

Genus BARYSPIRA Fischer, 1883.

Type: *Ancillaria australis* Sowerby.

Baryspira n. sp.

A small incomplete specimen 11.5 mm. long resembling a young *B. mucronata* (Sowerby). The protoconch projects clear of the apical callus, and the spiral depressed area below the smooth area is relatively wider than in *B. mucronata*.

Locality: Whenuataru Peninsula, Pitt Island.

Genus MARGINELLA Lamarck, 1801.

Type: *Voluta glabella* Linné.

Marginella coxi n. sp. (Fig. 134.)

Shell very small, oval, inflated. Spire low. Suture plainly marked by shallow depression. Spire-whorls slightly convex, body-whorl regularly convex, the base curved right to the anterior end. Surface smooth and polished. Aperture curving over above, bordered below. Outer lip thickened, but not ascending above penultimate whorl, practically smooth within, the merest traces of denticulation seen under a good lens and in favourable light. Columella with 4 strong plaits, the lower two stronger than the upper ones.

Height 4.5 mm.; diameter 3.2 mm.

Locality: Whenuataru Peninsula, Pitt Island.

Close to *M. harrisi* Cossman from the Lower Miocene of Awamoa but differing in its greater convexity. *M. harrisi* is relatively more produced anteriorly so that there is a flattening of the body whorl. Although the greater part of the unique type is decorticated, fragments of the surface show a better defined suture than *M. harrisi*.

Marginella floralis n. sp. (Fig. 135.)

Shell small, volutiform, solid. Surface smooth. Spire conical; protoconch obtuse; whorls about 4, convex on spire, body-whorl with a sloping broadly-rounded shoulder slightly convex below. Aperture wider below not notched anteriorly. Outer lip thickened only slightly ascending on to penultimate whorl, smooth within. Columella calloused, with four strong plaits the posterior one almost transverse, the rest oblique.

Height 7.5 mm.; diameter 5 mm.

Locality: Flower-pot Harbour, Pitt Island.

Genus ZEMACIES Finlay, 1926.

Type: *Zemacies elatior* Finlay.

Zemacies prendrevillei n. sp. (Fig. 141.)

Shell large, narrowly fusiform, strong. Suture with broad low border below. Sculpture of about 20 short oblique costae developed only on the rounded shoulder-angle; whole surface covered by fine, close spiral lines. Aperture long, sides subparallel, no anterior notch. Outer lip thin, with a deep, narrowly-rounded sinus its apex about middle of shoulder; below shoulder lip is strongly convex but contracts again to the widely-open canal. Inner lip smooth with a moderate callus.

Height (calculated) 95 mm.; diameter 27 mm.

Locality: Tuffs, Flower-pot Harbour, Pitt Island.

Shells belonging to *Zemacies* occur in New Zealand from the Hampden beds (*Surcula marginalis* Marshall) as high as the Mokau beds, *i.e.*, from Eocene to Miocene.

Genus MITRITHARA Hedley, 1922.

Type: *Columbella alba* Petterd.

Mitrihara granum n. sp. (Fig. 138.)

Shell small, biconical; spire conical about two-thirds aperture. Protoconch of two whorls, the nucleus bulbous and the second one increasing in size. Whorls nearly four slightly convex on spire, body-whorl regularly curved. Suture well marked, bordered below. Sculpture of about 20 low axial ribs per whorl with wider interstices. The ribs extend from suture to suture but are obsolete on body-whorl and do not cross base. Spire-whorls with about 6 weak spiral cords, the upper two close together and bordering suture, below is a wide concave space, then a fairly strong cord; between this and lower suture are three very weak threads. Where the upper three spirals cross the ribs they are slightly nodulous. Body-whorl with about 18 additional spiral threads, obsolete on the most expanded part of whorl but become stronger on base; interstices slightly wider. Also an additional thread on shoulder. Aperture not notched below. Outer lip thin with an extremely shallow sinus above. Columella with two strong oblique folds, considerably shorter than outer lip.

Height 8.3 mm.; diameter 4 mm.

Locality: Whenuataru Peninsula.

Genus INQUISITOR Hedley, 1918.

Type: *Pleurotoma sterrha* Watson.

Inquisitor acutus n. sp. (Fig. 142.)

Shell small; spire acute, nearly twice as high as aperture. Suture plain. Protoconch of about $2\frac{1}{2}$ smooth whorls, top one bulbous. Post-embryonic whorls $6\frac{1}{2}$, angled below middle on early ones but at middle on later ones; shoulder steeply inclined except in youth. Sculpture of short, curved, axial ribs 14 per whorl, slightly tubercular on shoulder-angle of body, but rather sharply raised on early whorls; no spirals. Aperture angled above, produced below into short, broad canal not notched at base. Outer lip thin with broadly rounded sinus stretching from suture to shoulder-angle. Inner lip thin.

Height 12.5 mm.; diameter 4 mm.

Locality: Whenuataru Peninsula, Pitt Island.

This shell is closely related to *Drillia costifer* Suter which is doubtfully separable from *Mangilia praecophinoides* Suter. The Chatham Island species has an extra whorl to the protoconch, no spirals are to be seen, and the number of whorls is greater.

Genus *GURALEUS* Hedley, 1918.Type: *Mangelia picta* Adams and Angus.*Guraleus lineatus* n. sp. (Fig. 139.)

Shell very small, broadly fusiform, spire equal in height to aperture and canal. Whorls 2 besides protoconch, angled about middle on spire, base gradually contracting to very short canal. Protoconch large, tectiform, of $3\frac{1}{2}$ whorls, ornamented by 4-5 spiral threads crossed by axials of equal strength. Sculpture consisting of 11 strong-curved axial ribs passing from suture to suture but soon dying out on base, these are crossed by fine very-widely-spaced spiral threads about 5 on spire whorls, 12-15 on body, the interspaces of all except a few on the neck with 4 or 5 microscopic threadlets trellised by equally fine growth-lines; aperture long, sides subparallel, produced into a short not contracted anterior canal not notched at base; outer lip thin, with semicircular notch extending from shoulder-angle to suture, convex below shoulder, columella straight and smooth.

Height 4.5 mm.; diameter 2.5 mm.

Locality: Flower-pot, Pitt Island.

Genus *LIRACRAEA* Odhner, 1924.Type: *Clathurella epentroma* Murdoch.*Liracraea titirangiensis* n. sp. (Fig. 137.)

Shell small, fusiform; spire equal in height to aperture and canal. Whorls five, convex; body fairly rapidly contracting to short straight neck. Protoconch of two whorls with a smooth tilted nucleus, the last whorl with three strong smooth spiral cords with interstices equally wide, sharply marked from the conch-whorls. Surface cancellate, with two strong spiral cords and a weaker one in the interstices, crossed by about 13 spaced axial ribs, body-whorl with five strong spirals with a weaker secondary and two still weaker tertiaries in the interstices, six or seven spirals anterior to these. Aperture pyriform, angled above, produced below into a short widely open canal, truncated at base. Outer lip thin, with a wide shallow notch adjoining suture. Columella smooth, straight.

Height 4.2 mm.; diameter 2 mm.

Locality: Titirangi.

Remarks: Closely related to *L. epentroma* Murdoch. The spirals do not start until after the nucleus of the protoconch and the spire is not so high.

Genus *PHENATOMA* Finlay, 1924.Type: *Pleurotoma novae-zelandiae* Reeve.*Phenatoma decessor* n. sp. (Fig. 144.)

This species is a direct ancestor of *P. novaezelandiae* (Reeve) which it resembles strongly in shape and ornamentation, but differs in having only 8 instead of 10 primary spirals below the shoulder on the body-whorl. The only protoconch observed shows no axial ribs such as appear on the last part of the protoconch of *P. novaezelandiae*, and there is scarcely any development of the secondary threads so

common in the Recent shell. The shoulder has a moniliform spiral thread bordering the suture, another about the middle and a single weak one between. In a *P. novaezelandiae* of the same size this last thread is represented by three separate ones.

Height 17 mm.; diameter 6 mm.

Localities: Whenuataru Peninsula, Pitt Island; Flower-pot Harbour, Pitt Island.

Genus *RETUSA* Brown, 1827.

Type: *Voluta alba* Kanmacher.

***Retusa pressa* n. sp.** (Fig. 136.)

Shell minute, subcylindrical, relatively short and wide. Summit concave, with nucleus projecting above level of rim. No sculpture. Columella with a low wide fold.

Height 2.5 mm.; diameter 1.5 mm.

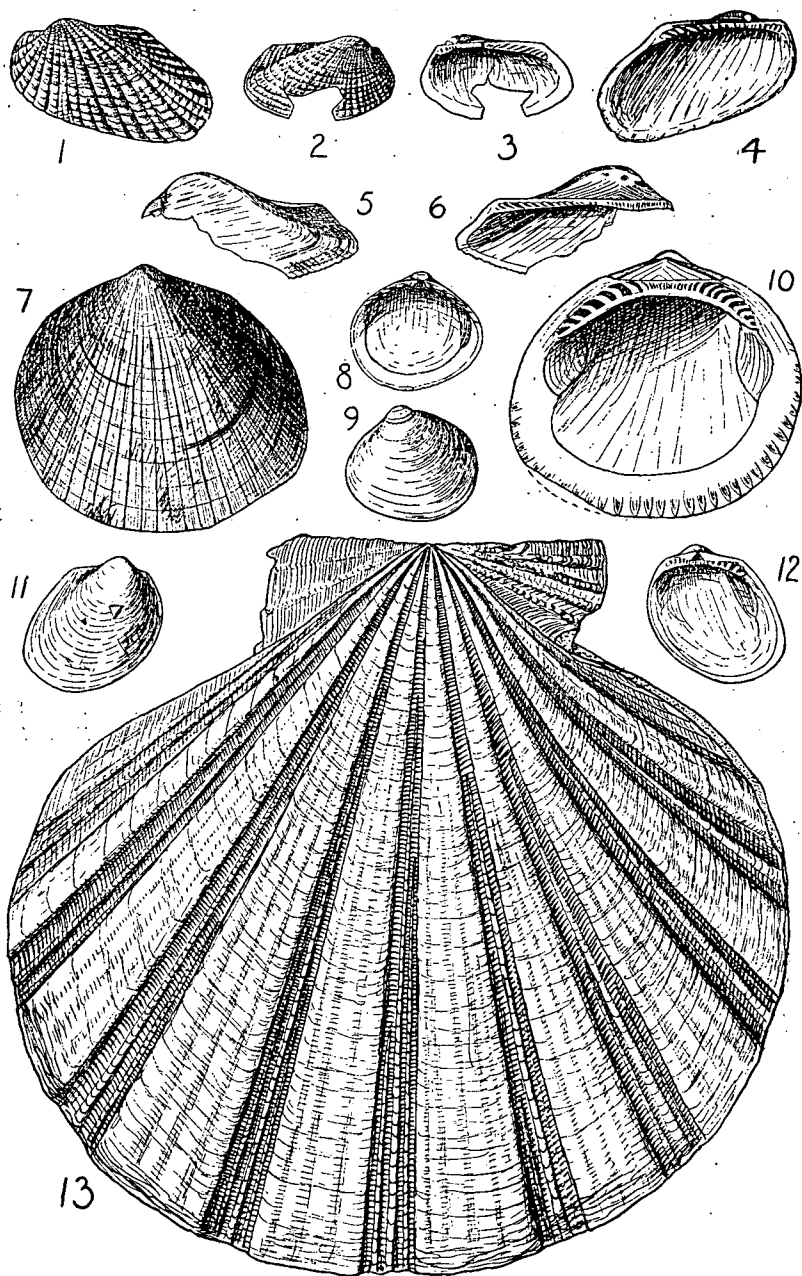
Locality: Whenuataru Peninsula.

Resembling *R. charlottae* (Suter), but easily distinguished by its relatively much greater width.

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FIGS. 1, 4.—*Barbatia* (Acar) *whangaensis* n. sp., holotype x 4, p. 440.

FIGS. 2, 3.—*Barbatia* (*Pugilarca*) *barneaformis* n. subgen., n. sp., holotype x 1, p. 441.

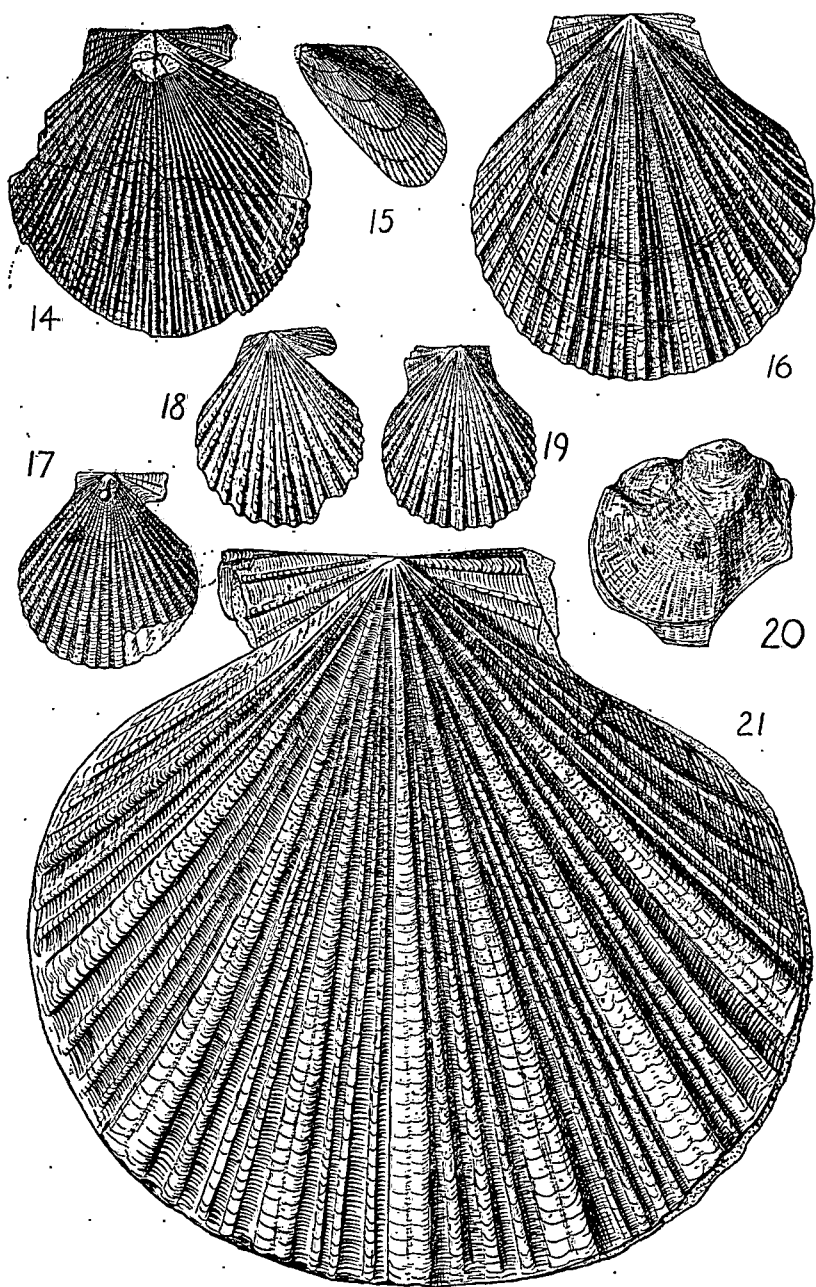
FIGS. 5, 6.—*Arca pittensis* n. sp., holotype x 1, p. 440.

FIGS. 7, 10.—*Glycymeris huntii* n. sp., holotype x 1, p. 442.

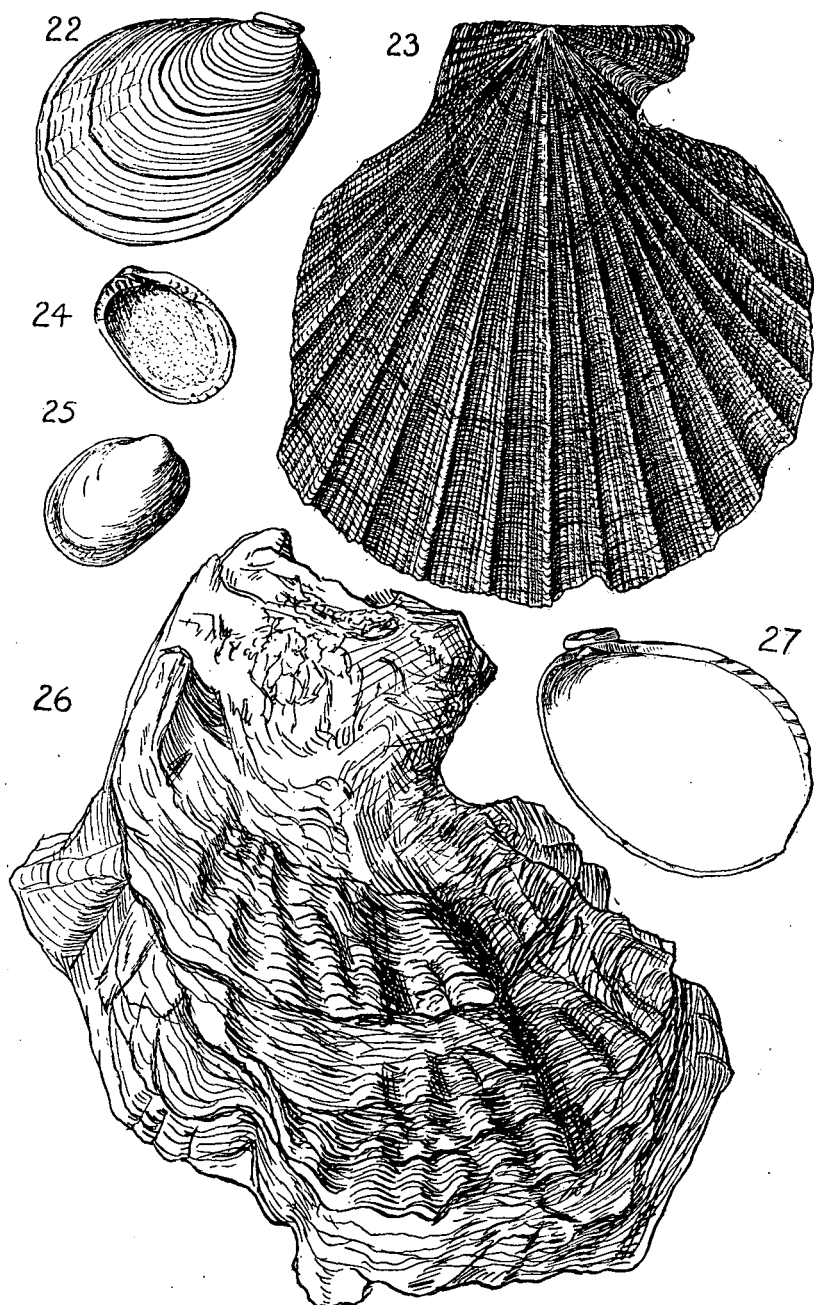
FIGS. 8, 9.—*Perrierina ovata* n. sp., holotype x 10, p. 444.

FIGS. 11, 12.—*Limopsis invalida* n. sp., holotype x 2½, p. 443.

FIG. 13.—*Sectipecten allani* n. gen., n. sp., holotype x 1, p. 459.



- FIG. 14.—*Serripecten tiorioriensis* n. gen., n. sp., holotype x 1, p. 458.
 FIG. 15.—*Mytilus (Aulacomya) willetsi* n. sp., holotype x 2, p. 444.
 FIG. 16.—*Sectipecten toaensis* n. gen., n. sp., holotype x 1, p. 459.
 FIG. 17.—*Chlamys mercuria* n. sp., holotype x 2, p. 457.
 FIGS. 18, 19.—*Chlamys chathamensis* (Hutton), neotype x 1, p. 456.
 FIG. 20.—*Monia furcilla* n. sp., holotype x 1½, p. 444.
 FIG. 21.—*Sectipecten allani* n. sp., holotype x 1, p. 459.



FIGS. 22, 27.—*Philobrya galerita* n. sp., holotype x 25, p. 443.
 FIG. 23.—*Chlamys seymouri* n. sp., holotype x 1, p. 457.
 FIGS. 24, 25.—*Lissarca fossilis* n. sp., holotype x 5, p. 442.
 FIG. 26.—*Ostrea waitangiensis* n. sp., holotype x 1, p. 462.

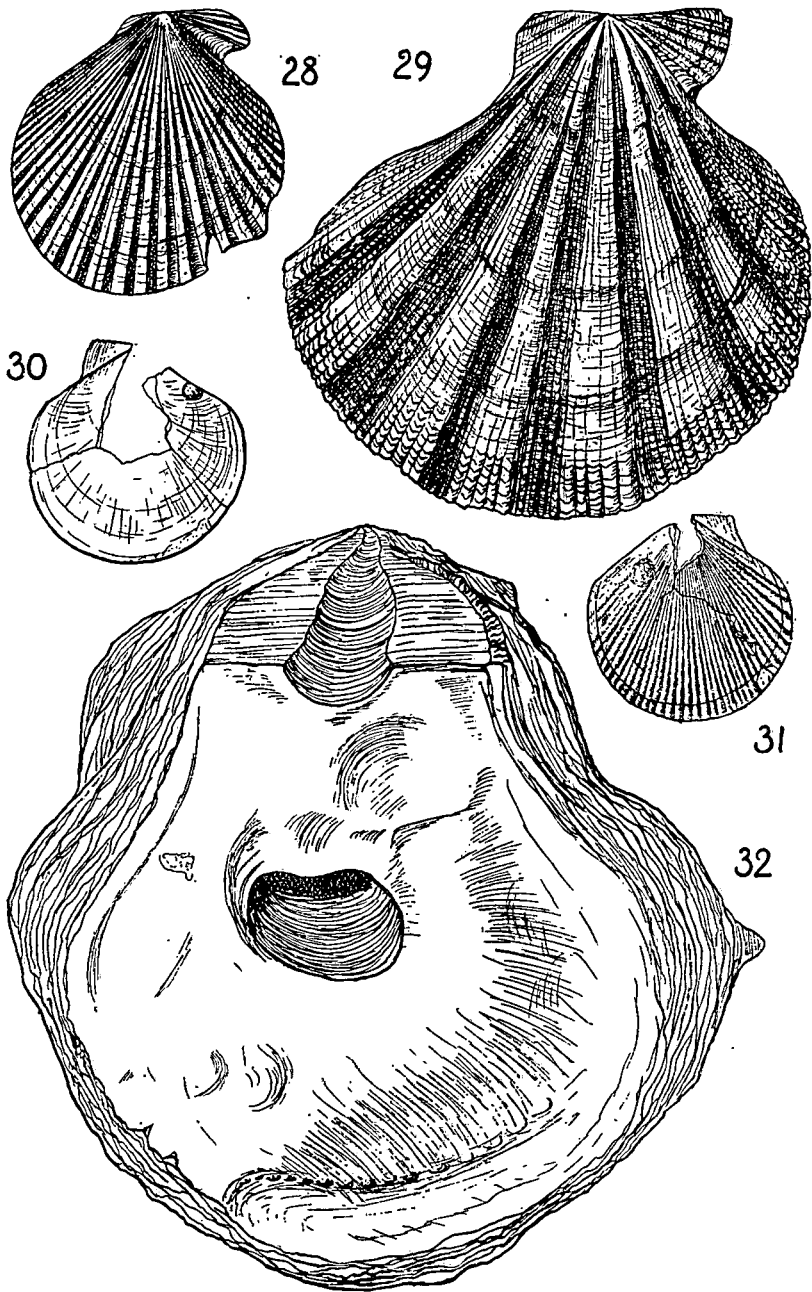


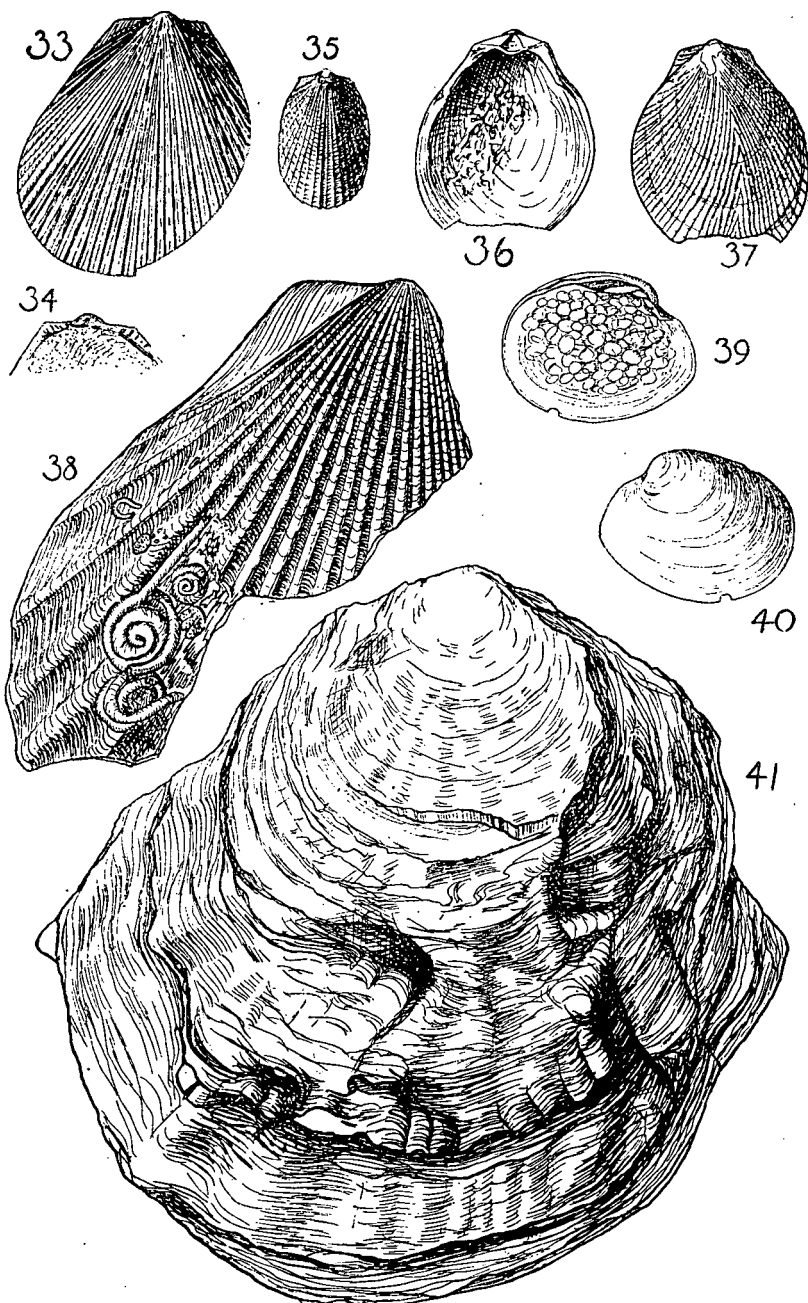
FIG. 28.—*Chlamys titirangiensis* n. sp., holotype x 1, p. 458.

FIG. 29.—*Pallium* (?*Felipes*) *dendyi* (Hutton), topotype x 1, p. 458.

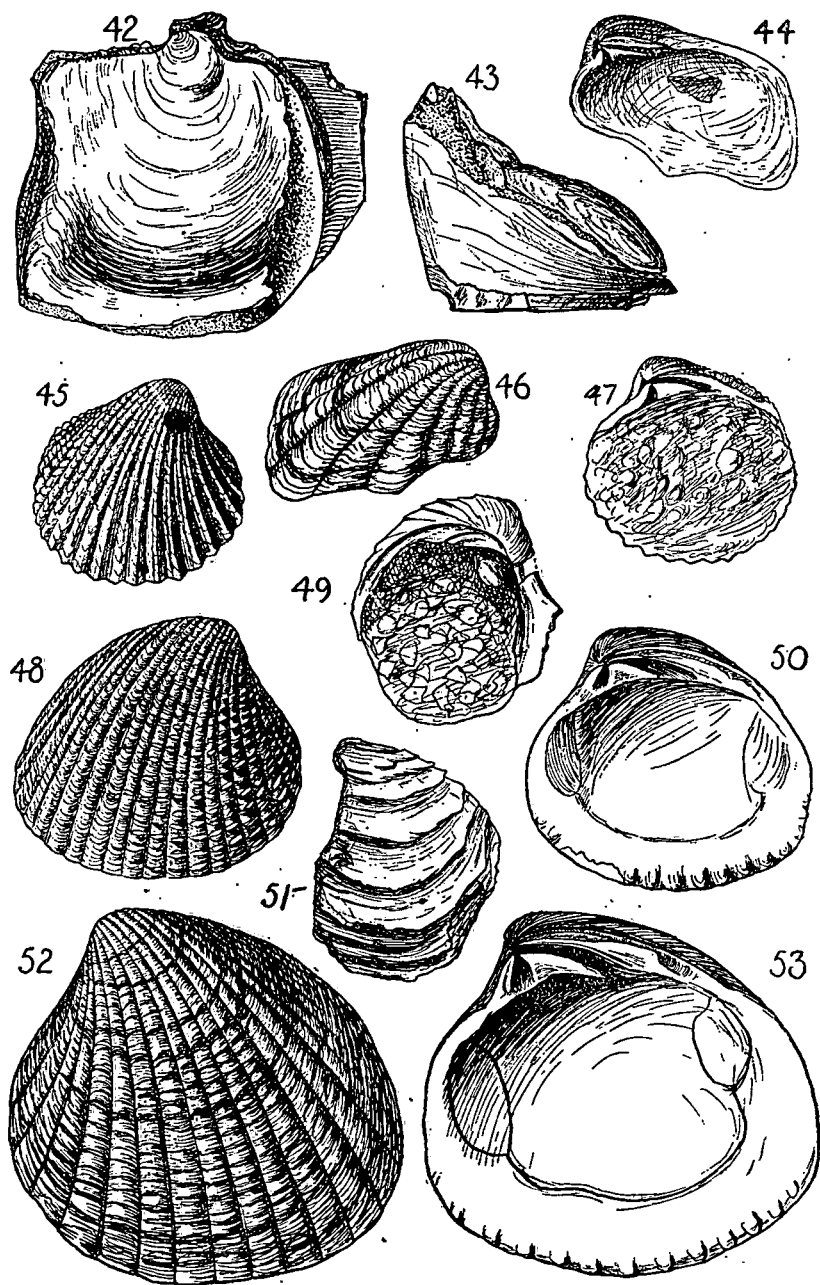
FIG. 30.—*Lentipecten* (*Duplipecten*) *imperfectus* n. subgen., n. sp., holotype, r. valve x 1, p. 460.

FIG. 31.—*Lentipecten imperfectus* n. subgen., n. sp., holotype, l. valve x 1, p. 460.

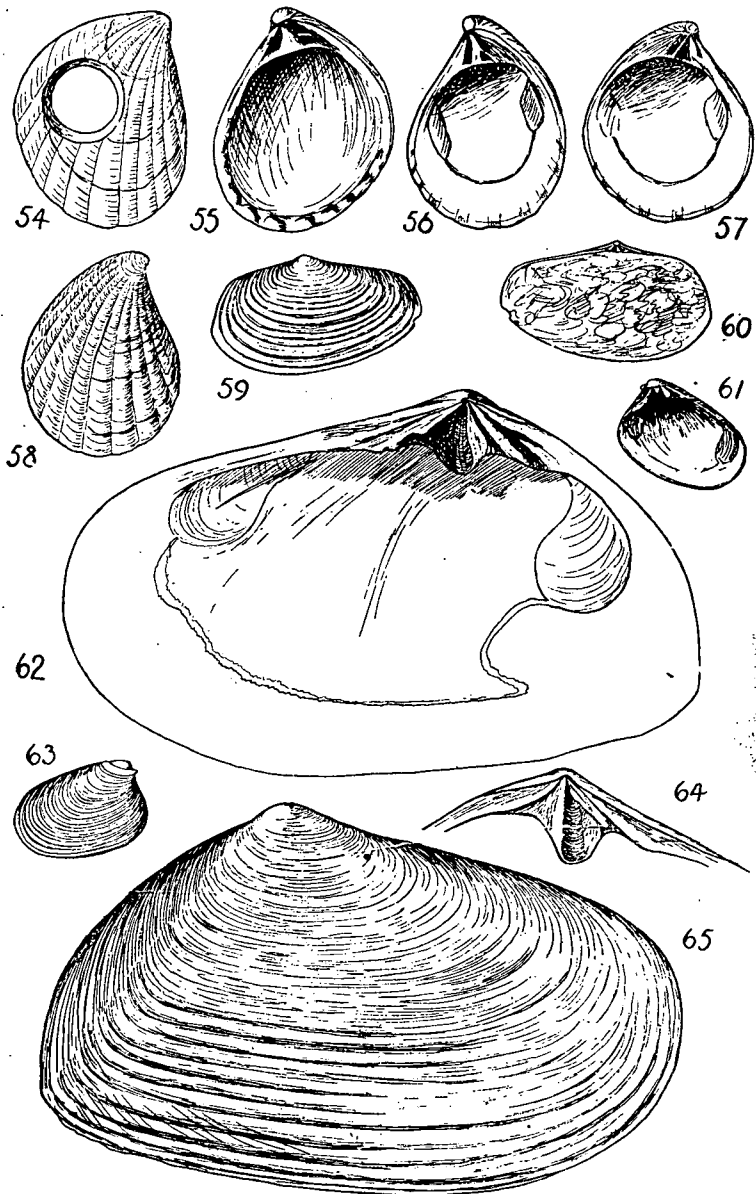
FIG. 32.—*Ostrea canoni* n. sp., holotype x 1, p. 462.



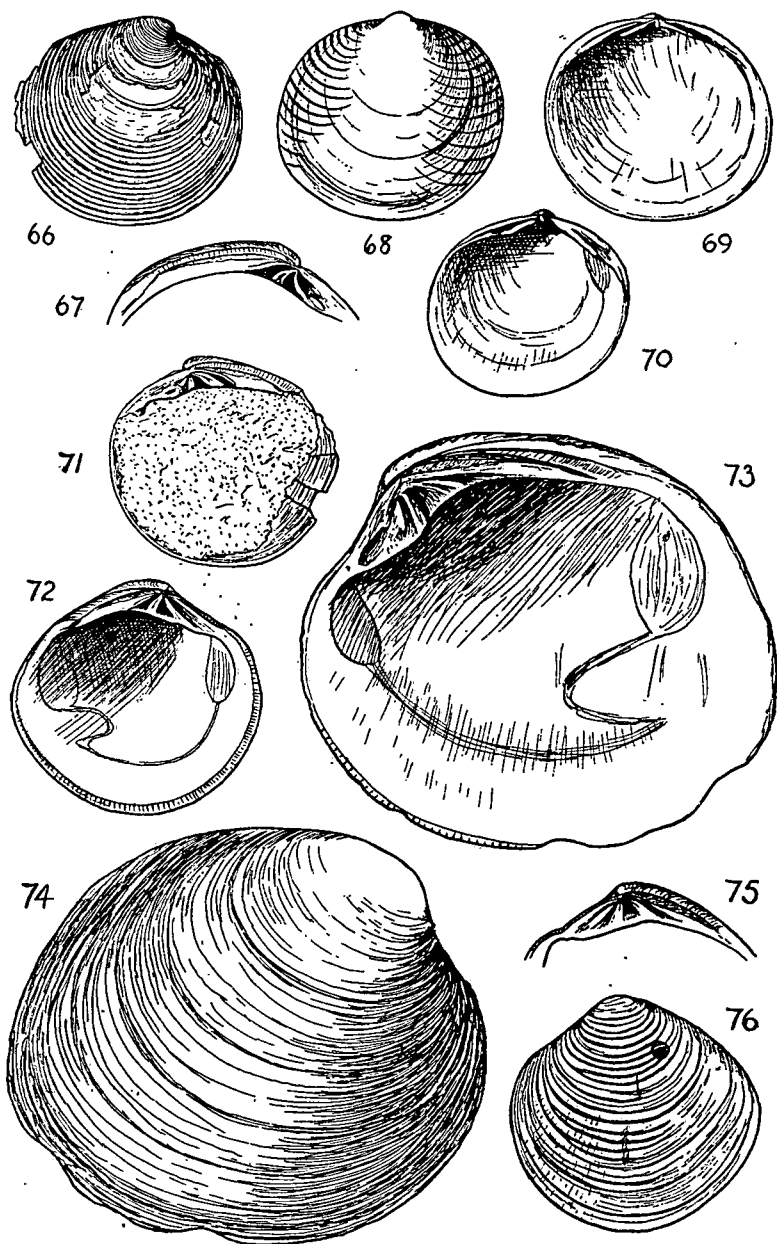
FIGS. 33, 34.—*Limea chathamensis* n. sp., holotype $\times 2\frac{1}{2}$, p. 461.
 FIG. 35.—*Limatula morioria* n. sp., holotype $\times 1$, p. 461.
 FIGS. 36, 37.—*Ctenoides naufragus* n. sp., holotype $\times 1$, p. 461.
 FIG. 38.—*Lima vasis* n. sp., holotype $\times 1$, p. 460.
 FIGS. 39, 40.—*Neogaimardia elegantula* n. sp., holotype $\times 10$, p. 463.
 FIG. 41.—*Ostrea cannoni* n. sp., holotype $\times \frac{1}{2}$, p. 462.



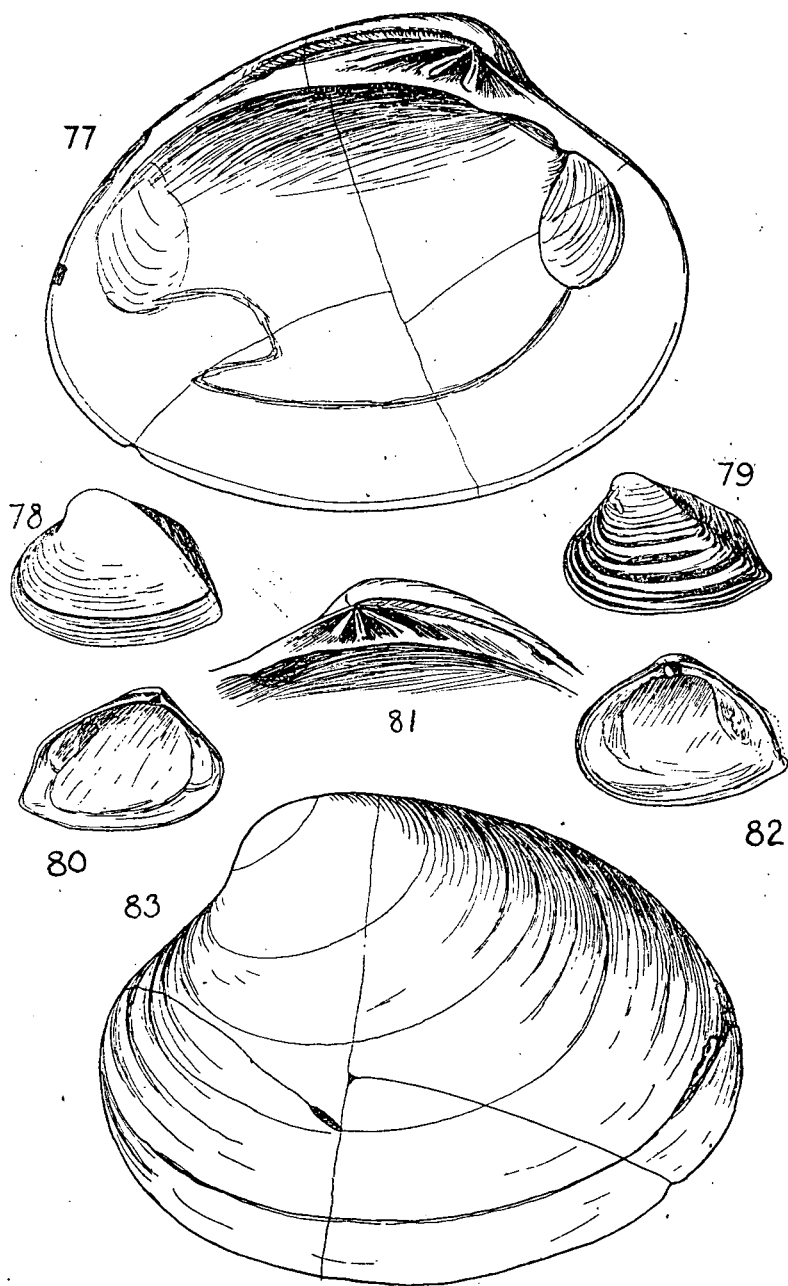
FIGS. 42, 43.—*Ostrea arcuata* n. sp., holotype x 1, p. 462.
 FIGS. 44, 46.—*Cardita northcrofti*, n. sp., holotype x 2, p. 464.
 FIGS. 45, 47.—*Venericardia muntia* n. sp., holotype x 2, p. 466.
 FIGS. 48, 50.—*Venericardia beata* n. sp., holotype x 1, p. 465.
 FIGS. 49, 51.—*Chama pittensis* n. sp., holotype x 1, p. 466.
 FIGS. 52, 53.—*Venericardia martini* n. sp., holotype x 1, p. 465.



FIGS. 54, 55.—*Cuna antiqua* n. sp., holotype x 9, p. 464.
 FIGS. 56, 58.—*Cuna firma* n. sp., holotype x 9, p. 464.
 FIG. 57.—*Cuna firma* n. sp., paratype x 9, p. 464.
 FIGS. 59, 60.—*Ascitellina donaciformis* n. gen., n. sp., holotype x 3, p. 467.
 FIGS. 61, 63.—*Condylocardia torquata* n. sp., holotype x 9, p. 466.
 FIGS. 62, 65.—*Amphidesma (Taria) porrectum* n. sp., holotype x 0.9, p. 468.
 FIG. 64.—*Amphidesma (Taria) porrectum* n. sp., paratype x 0.9, p. 468.



FIGS. 66, 71.—*Dosinia (Kereia) chathamensis* n. sp., holotype x 1, p. 469.
 FIG. 67.—*Dosinia (Kereia) chathamensis* n. sp., paratype x 1, p. 469.
 FIGS. 68, 69.—*Myllitella pinguis* n. sp., holotype x 8, p. 467.
 FIG. 70.—*Myllitella pinguis* n. sp., paratype x 8, p. 467.
 FIGS. 72, 76.—*Tawera marthae* n. sp., holotype x 1, p. 471.
 FIGS. 73, 74.—*Bassinaria macclurigi* n. gen., n. sp., holotype x 1, p. 470.
 FIG. 75.—*Tawera marthae* n. sp., paratype x 1, p. 471.



FIGS. 77, 81, 83.—*Eumarcia plana* Marwick, Titirangi, x 1, p. 472.

FIG. 78.—*Corbula tophina* n. sp., holotype x 3, p. 473.

FIGS. 79, 80.—*Corbula howesi* n. sp., holotype x 2, p. 472.

FIG. 82.—*Corbula howesi* n. sp., paratype x 2, p. 472.

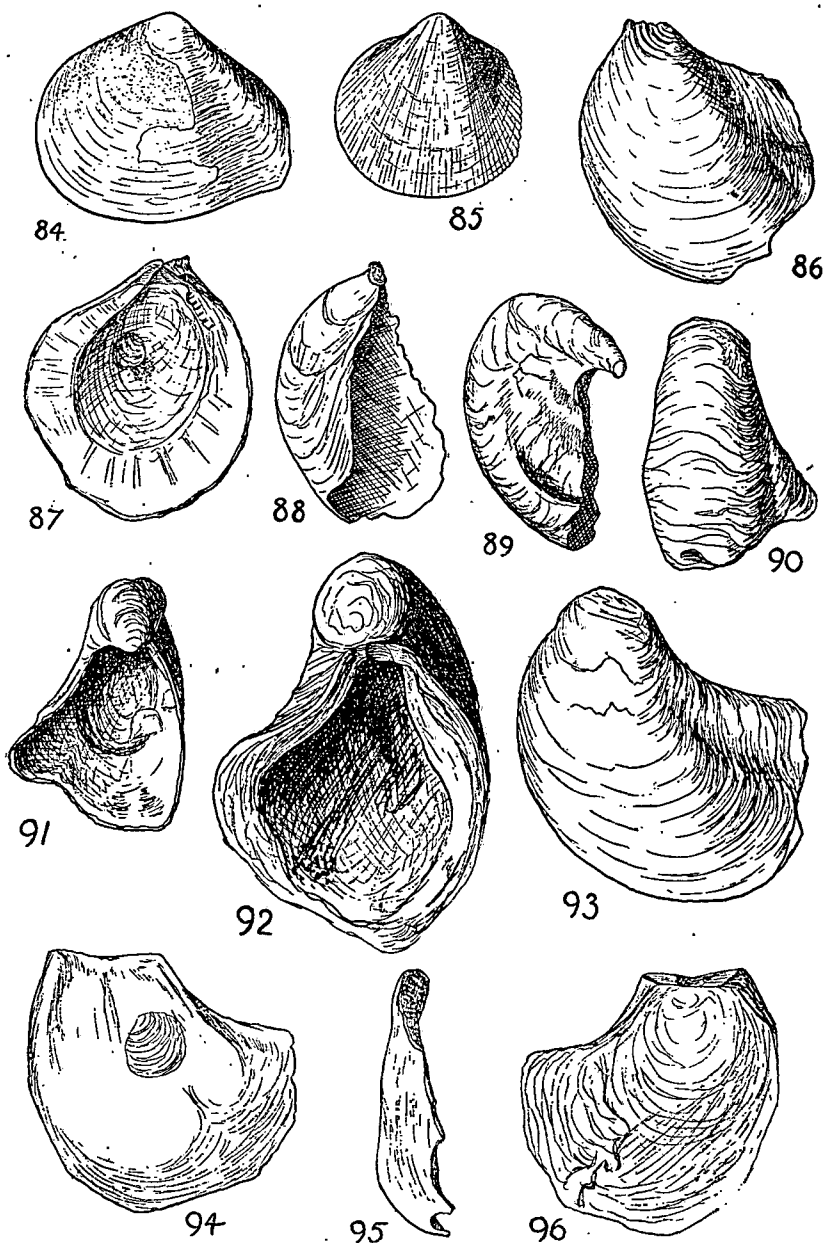


FIG. 84.—*Leptomya concentrica* n. sp., holotype x 2, p. 468.

FIG. 85.—*Nemocardium diversum* n. sp., holotype x 1, p. 472.

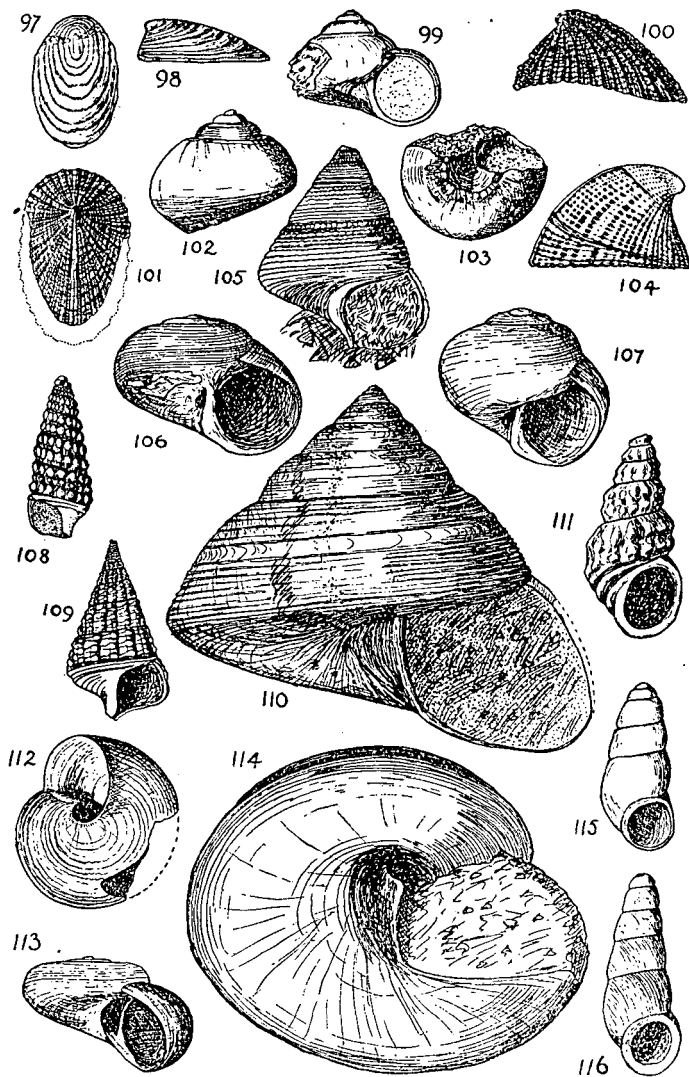
FIGS. 86, 87, 88.—*Notostrea tarda* (Hutton), little curved specimen x 1, p. 462.

FIGS. 89, 90, 91.—*Notostrea tarda* (Hutton), well curved specimen x 1, p. 462.

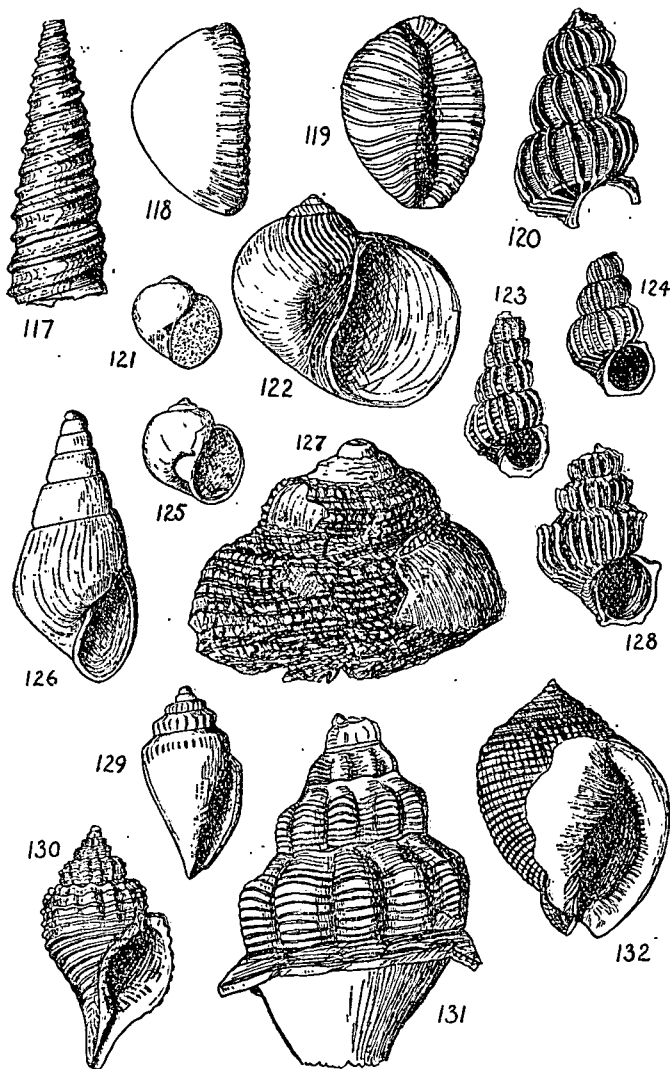
FIG. 92.—*Notostrea tarda* (Hutton), thick specimen x 1.

FIG. 93.—*Notostrea tarda* (Hutton), posteriorly elongated spec. x 1.

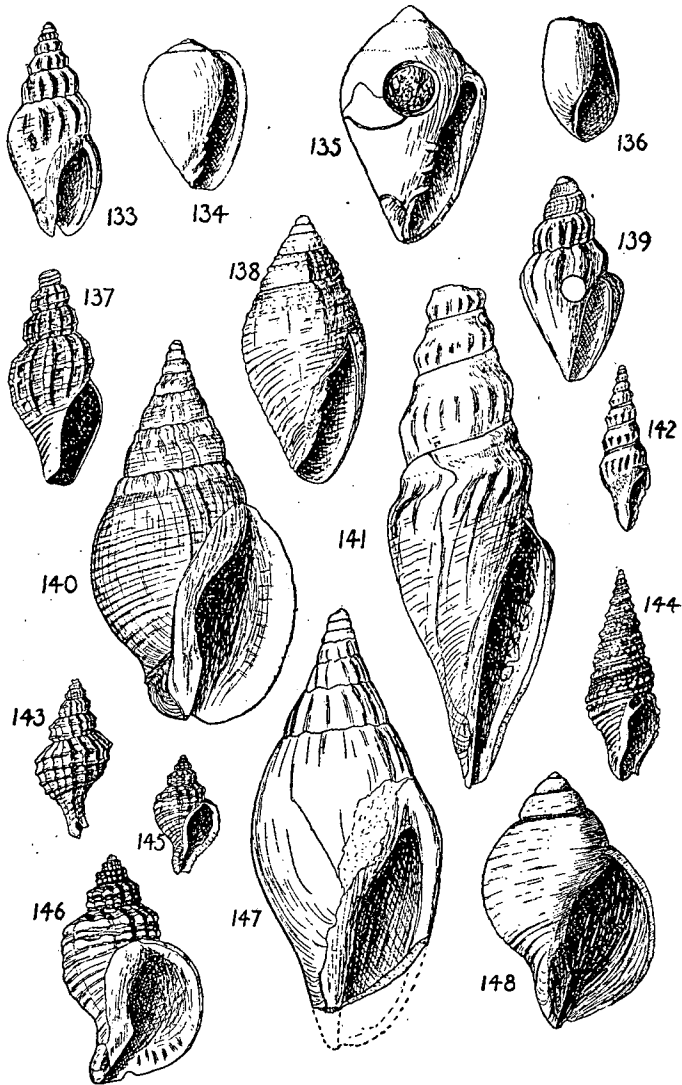
FIGS. 94, 95, 96.—*Notostrea tarda* (Hutton), front, side and back views of right valve of spec. of fig. 93, x 1.



- FIGS. 97, 98.—*Atalacmea elata* n. sp., holotype x 4, p. 473.
 FIG. 99.—*Margarella runcinata* n. sp., holotype x 2.5, p. 475.
 FIG. 100.—*Emarginula pittensis* n. sp., holotype x 2.5, p. 473.
 FIG. 101.—*Tugalia aranea* n. sp., holotype x 1.25, p. 474.
 FIGS. 102, 103.—*Zeminolia lenis* n. sp., holotype x 5.5, p. 476.
 FIG. 104.—*Emarginula galeriformis* n. sp., holotype x 2.5, p. 474.
 FIG. 105.—*Maurea finlayi* n. sp., holotype x 1.75, p. 476.
 FIG. 106.—*Argalista arta* n. sp., holotype x 8.5, p. 477.
 FIG. 107.—*Argalista effusa* n. sp., holotype x 8.5, p. 476.
 FIG. 108.—*Notosinister insertus* n. sp., holotype x 6, p. 479.
 FIG. 109.—*Ataxocerithium simplex* n. sp., holotype x 2.5, p. 479.
 FIGS. 110, 114.—*Perotrochus allani* n. sp., holotype x .85, p. 474.
 FIG. 111.—*Merelina avita* n. sp., holotype x 8.5, p. 478.
 FIGS. 112, 113.—*Rangimata pervia* n. gen., n. sp., holotype x 8.5, p. 477.
 FIG. 115.—*Estea insulana* n. sp., holotype x 8.5, p. 478.
 FIG. 116.—*Estea subtilicosta* n. sp., holotype x 8.5, p. 478.



- FIG. 117.—*Turritella (Spirocolpus) solomoni* n. sp., holotype x .85, p. 480.
 FIGS. 118, 119.—*Trivia flora* n. sp., holotype x 2.5, p. 482.
 FIG. 120.—*Cirsoctrema chathamense* n. sp., holotype x 2, p. 483.
 FIG. 121.—*Globisium mucronatum* n. sp., holotype x .85, p. 481.
 FIG. 122.—*Korovina accelerans* n. sp., holotype x 8.5, p. 481.
 FIG. 123.—*Cirsoctrema propelyratum* n. sp., holotype x .85, p. 483.
 FIG. 124.—*Cirsoctrema parvulum* n. sp., holotype x 2.5, p. 483.
 FIG. 125.—*Cochlis pittensis* n. sp., holotype x .85, p. 481.
 FIG. 126.—*Odostomia pittensis* n. sp., holotype x 6, p. 484.
 FIG. 127.—*Imperator anthropophagus* n. sp., holotype x .85, p. 477.
 FIG. 128.—*Cirsoctrema (Tioria) youngi* n. subgen., n. sp., holotype x 1.25, p. 484.
 FIG. 129.—*Austromitra plicifera* n. sp., holotype x 2.5, p. 485.
 FIG. 130.—*Elthica (Pittela) valida* n. subgen., n. sp., holotype x .85, p. 486.
 FIG. 131.—*Austrosipho (Verconella) asper* n. sp., holotype x .85, p. 485.
 FIG. 132.—*Phalium (Kahua) skinneri* n. subgen., n. sp., holotype x .85, p. 482.



- FIG. 133.—*Cominella (Eucominia) bauckei* n. sp., holotype x .85, p. 486.
 FIG. 134.—*Marginella coxi* n. sp., holotype x 4.25, p. 489.
 FIG. 135.—*Marginella floralis* n. sp., holotype x 4.25, p. 489.
 FIG. 136.—*Retusa pressa* n. sp., holotype x 6.5, p. 492.
 FIG. 137.—*Liracraea titrangensis* n. sp., holotype x 6.5, p. 491.
 FIG. 138.—*Mitrithara granum* n. sp., holotype x 4.25, p. 490.
 FIG. 139.—*Guraleus lineatus* n. sp., holotype x 6, p. 491.
 FIG. 140.—*Cominella (Eucominia) ellisoni* n. sp., holotype x .85, p. 487.
 FIG. 141.—*Zemacies prendrevillei* n. sp., holotype x .85, p. 489.
 FIG. 142.—*Inquisitor acutus* n. sp., holotype x 1.6, p. 490.
 FIG. 143.—*Zeatrophon lassus* n. sp., holotype x 1.6, p. 487.
 FIG. 144.—*Phenatoma decessor* n. sp., holotype x 1.6, p. 491.
 FIGS. 145, 146.—*Zeatrophon mutabilis* n. sp., paratypes x .85, p. 488.
 FIG. 147.—*Waihaeia (Pachymelon) renwicki* n. sp., holotype x .85, p. 488.
 FIG. 148.—*Zeatrophon mutabilis* n. sp., holotype x .85, p. 488.