Tertiary Molluscan Faunules from the Waitemata Beds.

By A. W. B. Powell, Auckland Museum.

[*Read before the Auckland Institute, April 18, 1938; received by the Editor, May 5, 1938; issued separately, December, 1938.*]

Since the first paper on the Waitemata Beds (Powell and Bartrum, 1929, *Transactions of the New Zealand Institute,* vol. 60, pp. 395–447) I had the good fortune to locate at Squadron or " Church " Bay, Waiheke Island, almost a replica of the original Oneroa bed. The new locality is about one mile to the south-west across the island from Oneroa and on the western coast. Apparently some short time prior to my discovery of the new bed a series of strong gales caused a landslide which exposed a large face of fossiliferous mudstone cliff. The removal of the debris and accumulated shingle by the same agency laid bare also for a time a tidal area of mudstone about 80 yards long by 30 to 40 yards wide which was very rich in fossils. Underlying this zone and exposed at the extremities of the platform is a coarse conglomerate composed of greywacke debris from the undermass, and this proved rich in derived fossils including *Parapholas* (genus new to New Zealand) and many opercula of *"Turbo" superbus.*

As will be seen from the combined list for the two localities, many of the species are common to both beds. A number of new species from these localities form the subject of this paper, as well as novelties from two other Waitemata basal beds—Motuihi Island, west side (not previously recorded) and east side of Bostaquet Bay, Kawau Island (locality described by Ferrar, *N.Z. Geol. Surv. Bull.,* No. 34, New Series, p. 37).

To return to the Squadron Bay bed, it was found that the most abundant species were *Eucrassatella ampla, Dosinia bensoni, Cardium greyi, Maoricolpus gittosina, M. waitemataensis* and *Polinices oneroaensis,* all except the latter being more abundantly represented at Squadron Bay than in the bed near Oneroa. The further material indicates no reconsideration in respect to the assumed age of these basal Waitemata beds, which in 1929 (p. 396) were considered by Powell and Bartrum to belong to the Hutchinsonian Stage of the Upper Oligocene.

Mollusca from Tertiary Beds at Waiheke Island, Auckland.

A: Original bed near Oneroa (described by Powell and Bartrum, 1929).
B: Oneroa Beach (rarely free from sand).
C: Newly discovered bed at Squadron Bay.
* : New records.

Class PELECYPODA.

Nucula cf. *nitidula* A. Adams, 1856	A
Anomia trigonopsis Hutton, 1877	A & C
Navicula waitemataensis Powell and Bartrum, 1929 ..	A
**Glycymeris (Grandaxinea) aucklandica* n.sp.	C

Mytilus tetleyi Powell and Bartrum, 1929	A
Musculus cf. *impactus* (Hermann, 1782)	A
Pteria oneroaensis (Powell and Bartrum, 1929)	A
**Pedalion* n.sp.	C
**Pedalion* n.sp.	B
Lima sp. (indet.)	A
Ostrea (Gigantostrea) gittosina Powell and Bartrum, 1929	A & C
Eucrassatella ampla (Zittel, 1865)	A & C
**Venericardia (Megacardita) squadronensis* n.sp.	A & C
Venericardia sp. juv. (indet.)	A
Chama sp. (indet.)	A
Notomyrtea sp. (indet.)	A
Melliteryx mirificus Powell and Bartrum, 1929	A
Maoritellina hesterna Powell and Bartrum, 1929	A
Angulus robini (Finlay, 1924)	A
Bartrumia oneroaensis (Powell and Bartrum, 1929)	A
Leptomya waitemataensis Powell and Bartrum, 1929	A
Scalpomactra biconvexa Powell and Bartrum, 1929	A & C
Lutraria trapezoidalis Powell and Bartrum, 1929	A & C
Zenatia acinaces (Q. and G., 1835)	A & C
Dosinia cf. *lambata* (Gould, 1850)	A & C
Dosinia (Raina) bensoni Marwick, 1927	A & C
Tawera cf. *bartrumi* Marwick, 1927	A
**Eumarcia (Atamarcia) curta* (Hutton, 1873)	A
Cardium (Trachycardium) greyi Hutton, 1873	A & C
**Cardium oneroaensis* n.sp.	C
Gari cf. *lineolata* (Gray, 1835)	A
Notocorbula pumila (Hutton, 1885)	A & C
Notocorbula aff. *zelandica* (Q. and G., 1835)	A
Hiatella sp.	A
Panopea orbita (Hutton)	A
Bankia turneri Powell and Bartrum, 1929	A
**Parapholas aucklandica* n.sp.	C

Class GASTEROPODA.

Haliotis sp. (indet.) probably *waitemataensis* n.sp.	A
Tugali navicula Finlay, 1926	A
Modelia aff. *granosa* (Martyn, 1784)	A
Sarmaturbo superbus (Zittel, 1864)	A & C
Cellana thomsoni Powell and Bartrum, 1929	A
Bembicium priscum Powell and Bartrum, 1929	A
Estea verticostata Powell and Bartrum, 1929	A
Notosetia cf. *stewartiana* (Suter, 1908)	A
Subonoba aff. *fumata* (Suter, 1898)	A
Nozeba candida Finlay, 1924	A
Zefallacia benesulcata Powell and Bartrum, 1929	A & C
Pyrazus consobrinus Powell and Bartrum, 1929	A & C
Pyrazus waitemataensis Powell and Bartrum, 1929	A & C
Maoricolpus gittosina Powell and Bartrum, 1929	A & C
Maoricolpus waitemataensis Powell and Bartrum, 1929	A & C
Zeacolpus tetleyi Powell and Bartrum, 1929	A
Struthiolaria lawsei Powell and Bartrum, 1929	A & C

Zegalerus peramplus Powell and Bartrum, 1929 . . . . A
Sigapatella patulosa Powell and Bartrum, 1929 . . . . A
Sigapatella subvaricosa Powell and Bartrum, 1929 . . A
Maoricrypta aff. *opuraensis* Bartrum and Powell, 1928 . . A
Maoricrypta aff. *costata* (Sowerby, 1824) . . . . A
Polinices oneroaensis Powell and Bartrum, 1929 . . . . A & C
**Magnatica (Spelaenacca) waitemataensis* n.sp. C
**Willungia fracta* (Tomlin, 1916) C
Cabestana tetleyi (Powell and Bartrum, 1929) . . . . A & C
**Mayena bartrumi* n.sp. C
Proxicharonia arthritica (Powell and Bartrum, 1929) . . A & C
**Euspinacassis oneroaensis* n.sp. . . . . A
Morum (Oniscidia) harpaformis Powell and Bartrum, 1929 A
Pyrgulina cf. *pseudorugata* Marsh. and Murd., 1921 . . A
Diplomitra waitemataensis Powell and Bartrum, 1921 . . A
Austrosipho (Verconella) exoptatus Powell & Bartrum, 1929 A
Buccinulum (Evarnula) tetleyi Powell and Bartrum, 1929 . . A
Austrofusus (Neocola) oneroaensis Powell & Bartrum, 1929 A
Cominella (Paracominia) lignaria Powell and Bartrum, 1929 A & C
Cominella (Paracominia) finlayi Powell and Bartrum, 1929 A & C
Murexsul echinophorus Powell and Bartrum, 1929 . . A
Vesanula waitemataensis (Powell and Bartrum, 1929) . . A
Xymenella asperula (Powell and Bartrum, 1929) . . A
Lepsiella maxima Powell and Bartrum, 1929 . . . . A & C
Lepsiella intermedia Powell and Bartrum, 1929 . . . . A
**Hima (Mirua)* aff. *socialis* (Hutton, 1886) C
Baryspira platycephala Powell and Bartrum, 1929 . . A & C
**Waihaoia* n.sp. C
Austrotoma finlayi n.sp. . . . . A & C
Rugobela sepelibilis (Powell and Bartrum, 1929) . . . . A
Inquisitor cf. *awamoaensis* (Hutton, 1873) . . . . A
Phenatoma (Cryptomella) transenna (Suter, 1917) . . A
Acteon oneroaensis Powell and Bartrum, 1929 . . . . A
Cylichnina enucleata Powell and Bartrum, 1929 . . . . A

Class AMPHINEURA.

Ischnochiton vetustus Powell and Bartrum, 1929 . . . . A

Class SCAPHOPODA.

Dentalium sp. . . . . A & C

GLYCYMERIDAE.

Genus GLYCYMERIS Da Costa, 1778.

Type (tautonomy): *Arca glycymeris* Linn.

Subgenus GRANDAXINEA Iredale, 1931.

Type (orig. desig.): *G. magnificens* Iredale.

Glycymeris (Grandaxinea) aucklandica n.sp. (Pl. 38, fig. 9.)

This species shows relationship both to the Recent *laticostata* and the Awamoan (Burnt Hill) *monsadusta* Marwick (1932, *Rec. Cant. Mus.*, vol. 3, p. 496). The Waiheke species resembles *monsadusta* in having inflated beaks and a similar number of radial ribs

(32), but in shape it is nearer to *laticostata,* being proportionately wider than *monsadusta* and with a more broadly arched hinge line. The actual hinge teeth, however, are more massive than in *laticostata,* and the posterior end of the shell is slightly produced, a condition sometimes found in Recent *laticostata.* (Part of the postero-dorsal margin is broken away in the holotype.)

Height, 55 mm.; length, 56 mm.; inflation (one valve), 18 mm.

Locality: Squadron Bay, Waiheke Island, Auckland. Collected by A. W. B. P.

Holotype in Auckland Museum.

PTERIIDAE.

Genus PTERIA Scopoli, 1777.

Type (monotypy): *Mytilus hirundo* Linn.

The finding of further material shows that the holotype and paratype respectively of *Isognomon oneroaensis* Powell and Bartrum, 1929, are not the same species. The specimen selected as holotype had the hinge features obliterated, but showed an almost complete outline; the paratype, however, was a hinge fragment showing unmistakable ligamental pits.

It is now clear that the holotype of *Isognomon oneroaensis* is a *Pteria.* As the original description is inadequate, I now provide a description of a well preserved example collected by Mr. C. A. Fleming.

The paratype of *Isognomon oneroaensis* (1929, pl. 44, fig. 69) certainly is an *Isognomon* (= *Pedalion*), but cannot retain the name *oneroaensis* as the holotype of that species proves to be a *Pteria.* This figured paratype may be indicated as *Isognomon* n.sp., the specimen being too fragmentary to name. The position is further complicated by the finding in the same beds of several fragments of another species of *Isognomon* close to the Pliocene *zelandica* Suter.

Pteria oneroaensis (Powell and Bartrum, 1929).

1929. *Isognomon oneroaensis* Powell and Bartrum, *Trans. N.Z. Inst.,* vol. 60, p. 400, pl. 49, f. 106; not pl. 44, f. 69.

Description of neotype (pl. 38, fig. 4):—Shell large, nacreous, trapezoid, moderately and broadly inflated, the greatest inflation occurring medially along an arc extending from the umbo to the middle of the ventral margin. Dorsal margin moderately long (probably much longer than shown in the neotype), straight; umbo low. Anterior auricle rather large, triangular, set off from the rest of the shell by a depression extending from the long, rather narrow, byssal sinus to the front of the umbo. Anterior margin below the auricle almost vertical, posterior margin broadly rounded, steep, barely subangled where it joins the broadly rounded ventral margin. Cardinal area smooth and long, almost the length of the dorsal margin. Hinge teeth under umbo not exposed; the rest of the hinge

is shown to be plain, being exposed from the back by the breaking away of the right valve. Sculpture of weak concentric growth lines only.

Height, 100 mm.; diameter, 97 mm. (neotype).

Neotype in Auckland Museum Collection. Presented by Mr. C. A. Fleming.

Locality: Squadron Bay, Waiheke Island.

The species is much more erect in growth and has a considerably smaller posterior auricular area than in the normal form for the genus. In fact, its strong resemblance in form to *Isognomon* caused the curious error in the earlier paper on the Waiheke beds (Powell and Bartrum, 1929).

CRASSATELLITIDAE.

Genus EUCRASSATELLA Iredale, 1924.

Type (orig. desig.): *Crassatella kingicola* Lamarck.

Eucrassatella ampla (Zittel), 1865. (Pl. 38, figs. 1, 2 and 3.)

1865. *Crassatella ampla* Zittel, *Voy. "Novara," Palae.*, p. 46, pl. 14, f. 3 a, b.
1914. *Crassatellites amplus* (Zittel): Suter, *N.Z. Geol. Surv. Pal. Bull.*, no. 2, p. 47, pl. 13, f. 3. (Plesiotype.)
1929. *Eucrassatella attenuata* (Hutt.): Powell and Bartrum, *Trans. N.Z. Inst.*, vol. 60, p. 402, f. 107.

There has been some doubt as to whether Hutton's *attenuata* is distinct from *ampla*, but after examining long series I am convinced that there are two distinct species. Outline is deceptive, for this led Powell and Bartrum, 1929 (*l.c.*) to class a Waiheke shell as *attenuata* whereas on hinge characteristics it is decidedly *ampla*. Quite irrespective of outline, therefore, *ampla* may always be separated from *attenuata* by the more massive and proportionately deep hinge. The following measurements and ratios for a series of each species shows them to be distinguishable. Generally *ampla* is of trigonal outline and *attenuata*, as the name suggests, more elongate subtrigonal.

ampla:

*Length,	117	mm.; height,	85	mm.	Ratio hinge to height,	3.2	Waiheke.
„	120	„	100		„ „	3.3	„
„	121	„	102		„ „	3.4	„
„	130	„	115		„ „	3.3	„
„	134	„	106		„ „	3.3	„
„	95	„	80		„ „	—	Type

attenuata:

Length,	153	mm.; height,	116	mm.		—	Type
„	91	„	83		Ratio hinge to height,	3.8	Target Gully
„	98	„	64		„ „	4.0	„ „
„	113	„	85		„ „	3.8	„ „
„	113	„	83		„ „	3.6	Clifden 7a
„	117	„	82		„ „	3.9	„ „
„	119	„	85		„ „	3.5	Target Gully
„	122	„	93		„ „	3.5	„ „

* Figured specimen, Powell and Bartrum, 1929, f. 107.

CARDITIDAE.

Genus VENERICARDIA Lamarck, 1801.

Type (subsq. desig., Gray, 1847): *Venus imbricata* Gmel.

Subgenus MEGACARDITA Sacco, 1899.

Type (fide Dall., 1900): *Venericardia jouanneti* Basterot.

Venericardia (Megacardita) squadronensis n.sp. (Pl. 38, figs. 10, 11 and 12.)

Shell very large, massive, rhomboid; characterised by broad, flattened, radial ribs with linear interstices. Umbo prominent, at anterior fourth. Sculpture consisting of 26 radials, the last nine towards the posterior end being from a third to a half the width of the others, which are broad and flattened as described above. The concentric growth lines are obsolete over most of the shell, weak folds surmounting the radials being present only on the first seven radials from the anterior end. The holotype is imperfect in outline, but is selected as it shows the distinctive ribbing to best advantage; the figured paratype provides the outline of the species. Hinge as in *ponderosa* Suter.

Length, 81 mm.; height, 71 mm.; inflation (one valve), 23 mm. (paratype).

Locality: Squadron Bay, Waiheke Island, Auckland; east side of Bostaquet Bay, Kawau Island. Collected by A. W. B. P.

Holotype in the writer's collection, Auckland Museum: (Squadron Bay). (Pl. 38, fig. 10.)

This species is closely allied to Suter's *ponderosa* (*Trans. N.Z. Inst.*, vol. 45, p. 296) from Muddy Terrace, Waikaia, but differs in the ribs being more flattened and the interstices narrower. These differences are constant at all stages of growth.

CARDIIDAE.

Genus CARDIUM Linné, 1758.

Type (subsequent desig. Gray, 1847): *Cardium costatum* Linné.

Cardium oneroaensis n.sp. (Pl. 38, figs. 7 and 8.)

Shell large, subcircular, massive, much inflated; umbo at about anterior third, large, incurved, somewhat flattened on top. Sculptured with 41 broad, flattened radial ribs with linear interspaces; and well-developed nodose spines on the ribs towards the lower margin. Hinge massive; left valve with two cardinals joined above, the anterior one the larger, triangular; lower cardinals separated from one another by a large obliquely triangular socket, for the reception of the right valve cardinal. Anterior lateral strong, posterior lateral broken away. Nymph broad and strong.

Height, 93 mm.; length (estimated), 98 mm.; inflation (one valve), 40 mm. (holotype).

Locality: near Oneroa, Waiheke Island.

Holotype in writer's collection, Auckland Museum.

The species belongs to the *spatiosum* series, which includes *strangi* Laws, 1930, and *gudexi* Laws, 1933, as well as *spatiosum* Hutton, 1873.

PHOLADIDAE.

Genus PARAPHOLAS Conrad, 1849.

Type (monotypy): *Pholas californica* Conrad.

Parapholas aucklandica n.sp. (Pl. 38, figs. 5 and 6.)

Shell comparatively short, elliptical, anterior end bulbous, then rapidly contracting to the rather sharply pointed anterior end. Anterior end closed by a thin swollen callus, very slightly gaping. There is a single large, broad, anterior accessory plate (protoplax) as shown by the smooth rounded attachment surfaces on the valves. Two other accessory plates (the mesoplax and the metaplax) are double and confluent, and extend from the protoplax to within a short space of the posterior extremity of the shell. These plates are very broad medially and gradually taper behind. Valves divided into three areas by two radial folds, the first shown as a shallow groove and the second as a slight angle. Anterior portion with the upper part decussated by fine radial and concentric sculpture, and the lower part smooth callus; median and posterior portions with close regular concentric folds.

Length, 33 mm.; height, 20·5 mm.; diameter, 19 mm. (holotype).

Locality: Squadron Bay, Waiheke Island. Collected by A.W.B.P.

Holotype in Auckland Museum. (Pl. 38, fig. 5.)

Several specimens were found in situ in borings made by them in blocks of greywacke, which are scattered in a coarse conglomerate underlying the mudstone.

This is the first record of the genus *Parapholas* in New Zealand, the genotype being a Californian Recent species.

Pholadidea thomsoni Suter, 1917 (*N.Z. Geol. Surv. Pal. Bull.*, No. 5, p. 78), from Anthony Bay, Coromandel Peninsula, is not related.

TURBINIDAE.

Genus SARMATURBO n.gen.

Type: *Turbo superbus* Zittel.

Sarmaturbo superbus (Zittel). (Pl. 39, figs. 1 and 2, operculum.)

1864. *Turbo superbus* Zittel, *Reise der Novara*, Geol. 2, pt. 1, p. 39, pl. 14, f. 2.

1929. *Sarmaticus* cf. *superbus* (Zittel) Powell and Bartrum, *Trans. N.Z. Inst.*, vol. 60, p. 413.

In the 1929 paper (Powell and Bartrum) Zittel's *Turbo superbus* was referred tentatively to the genus *Sarmaticus* Gray, 1847, the type of which is the South African Recent *Turbo sarmaticus*, although a single fragmentary specimen of an operculum, presumably of Zittel's species, was found to differ considerably from that of the South African genotype. In 1931, King (*Trans. N.Z. Inst.*, vol. 62, p. 80) described a large "*Turbo*" as *Bolma colini*, the species being closely allied to *superbus*. Now the genus *Bolma* Risso, 1826, has little

in common with these large New Zealand Tertiary shells, being smaller, of lighter build, having finer sculpture, and above all a smooth, polished operculum. In build and sculpture the New Zealand fossils closely resemble *Sarmaticus,* but the opercula of the respective species show them to be quite separable. Recently a number of opercula of *superbus,* together with fragments of the shells, have been taken from the conglomerate at Squadron Bay, and all are found to be heavily sculptured on the under side with deeply incised anastomising spiral grooves which cut up the central portion into irregular ridges and nodules. In contrast, the operculum of *S. sarmaticus* has the whole inner surface crowded with large irregular stony papillae with no trace of spiral arrangement.

An excellent figure of the *Sarmaticus* operculum is given by Pycraft in a nature article in the *Illustrated London News,* vol. 187, No. 5034, p. 596, October, 1935.

For these large New Zealand Tertiary *Turbos* I now provide the new generic name *Sarmaturbo* as indicated above, naming *Turbo superbus* Zittel as type and including *Bolma colini* King. Further new species occur at Castle Hill, Canterbury. It is probable that *Sarmaticus* and *Sarmaturbo* had a common origin, but on the evidence of the operculum generic identity cannot be upheld.

NATICIDAE.

Genus MAGNATICA Marwick, 1924.

Type (orig. desig.): *Polinices planispirus* Suter = *Natica suteri* Marwick.

Subgenus SPELAENACCA Finlay, 1926.

Type (orig. desig.): *Magnatica altior* Finlay, 1926.

Magnatica (Spelaenacca) waitemataensis n.sp. (Pl. 39, fig. 3.)

This shell is closely allied to Finlay's *clifdenensis* (*Trans. N.Z. Inst.,* vol. 56, p. 229, pl. 60, fig. 2). It is distinguished by having an even higher mammillate spire, and a more inflated body-whorl, resulting in a " D "-shaped aperture and a deeply concave, appressed suture. Umbilicus as in *clifdenensis,* situated low down, narrow, deep, and almost round, differing in being slightly narrower and in having a less clearly defined " escarpment " step down within the umbilicus, as well as a broader but weaker bounding fold. Spire exactly half the height of the aperture. Whorls 5½, including a small protoconch of 1½ low smooth whorls. Surface smooth and polished, with weak growth lines only.

Height, 37 mm.; diameter, 31·5 mm. (holotype).

Height, 24 mm.; diameter, 21·5 mm. (paratype).

Height, 35 mm.; diameter, 28·5 mm. (holotype of *clifdenensis*).

Locality: Squadron Bay, Waiheke Island, Auckland. Collected by A. W. B. P.

Holotype in Auckland Museum.

ERATOIDAE.

Genus WILLUNGIA nov.

Type: *Willungia tasmanica* n.sp.

A new genus of puzzling affinity, nearest to *Erato,* but differing widely in its globular shape, heavy basal fold (usually bifid) and strong columellar ridges, carried right across the fossula. Typical *Erato* is pyriform in shape and with crenulations rather than ridges on the columella, basal folds hardly distinguishable from the crenulations and always a smooth fossula. On the other hand, *Trivia* and its allies are globular rather than pyriform in shape and have columellar ridges traversing the fossula, but never the heavy basal fold of the new genus.

To this genus belong *Cypraea ovulatella* Tate, 1890 (pl. 39, fig. 5), from Aldinga, South Australia, (Aldingian) Miocene: *Willungia tasmanica* n.sp., which is *Cypraea ovulatella* of Pritchard, 1896 (*Proc. Roy. Soc. Vict.,* vol. 8, n.s.p. 106) not of Tate, from Table Cape, Tasmania, (Janjukian) Miocene: *Marginella fracta* Tomlin, 1916, n.n. for *Marginella ventricosa* Hutton, 1873 (*Cat. Tert. Moll.,* p. 8), from Broken River, Canterbury, N.Z., (Awamoan) Lower Miocene: and *Willungia maoria* n.sp. from Clifden, band 4, Southland, N.Z., (Hutchinsonian-Awamoan) Up. Oligocene-Lower Miocene.

Schilder (1933, *Proc. Malac. Soc., Lond.,* vol. 20, p. 269) has referred *ovulatella* Tate to *Austrocypraea,* but the weak, non-produced posterior canal (a faint sinus only) of *Willungia* is not in accord with that of *contusa* McCoy, the type of *Austrocypraea.* It would appear that *Willungia* represents a primitive Eratoid between *Eratotrivia* Sacco (type: *crenularis* Schilder) and *Architerato* Schilder (type: *pyrulata* Tate).

The genus name was adopted by Dr. H. J. Finlay in manuscript which he generously made available to the writer for publication. The name is based upon Port Willunga, near Aldinga, South Australia, the locality where the first species of the genus was found.

Willungia tasmanica n.sp. (Pl. 39, fig. 4.)

Shell large for the family, globular, much inflated; smooth except for labial and parietal ridges. Protoconch paucispiral, smooth, flattened, of 1½ whorls. Spire very short, about one-thirteenth height of the aperture. Labial varix heavy and rounded, very weakly calloused above on joining the body-whorl. Aperture rather open, slightly crescentic, rather wider below. Anterior canal broad and shallow, posterior canal narrower and indistinct. Outer lip with thirteen sharp ridges; being strongly dentate along the inner margin. Inner lip deeply excavated below, immediately above a strong bifid fold at the base of the columella. The parietal callus bears thirteen spiral to somewhat diverging, long, sharp ridges. These cross the weakly defined but rather broad fossula and extend almost halfway across the front of the body-whorl.

Height, 19 mm.; width, 15 mm. (holotype).

Locality: Table Cape, Tasmania (Janjukian).

Holotype in Auckland Museum (Dr. H. J. Finlay's Collection).

This species differs from *ovulatella* (Tate, 1890) in being much larger, more globular, and in having the parietal ridges extending almost halfway across the front of the body-whorl.

Willungia fracta (Tomlin, 1916). (Pl. 39, figs. 6 and 7.)

1873. *Marginella ventricosa* Hutton, *Cat. Tert. Moll.*, p. 8; not of G. Fisher, 1807.
1916. *Marginella fracta* Tomlin, *Journ. Conch.*, 15, p. 43; n.n. for *M. ventricosa* Hutt.
1918. *Cypraea ovulatella* Suter, *Alph. List N.Z. Tert. Moll.*, p. 12; not of Tate, 1890.

The type is a broken and imperfectly preserved specimen from Broken River, Canterbury, N.Z. Dr. Finlay, who has examined the type, considers it as probably identical with Suter's *"Cypraea ovulatella"* from the Trelissick Basin. A series of poorly preserved specimens from N.Z. Geol. Surv. loc. 241, tuffaceous greensands at Whitewater Creek, Trelissick Basin, appear to be conspecific with a much better preserved, although somewhat distorted specimen from Squadron Bay, Waiheke Island.

This species as represented by the Waiheke shell, differs from the genotype of *Willungia* in having the aperture considerably wider below, with a more shallow and broader anterior canal. Also the labial varix is more massive, particularly medially, and the inner lip plications do not extend far across the body-whorl. Basal fold with a median groove at first but not distinctly bifid. Labial ridges number 12, and there are 11 on the parietal wall in addition to the basal columellar fold.

Height, 18 mm.; width, 14·5 mm. (figured specimen from Squadron Bay).

Locality: Squadron Bay, Waiheke Island, N.Z.

A Trelissick specimen (pl. 38, fig. 6) from locality 241 shows the normal outline for the species. Internal casts from Kakanui tuffs in the collection of Dr. H. J. Finlay may be referred to this species.

Willungia maoria n.sp. (Pl. 39, figs. 8 and 9.)

Shell large, globular, inflation greatest above; labial varix heavy, extending full height of shell. Spire hardly raised (damaged in holotype). Aperture open, slightly crescentic, sides subparallel. Anterior canal shallow, moderately wide; posterior canal shallow but distinct. Outer lip with twelve sharp ridges, strongly dentate along the inner margin. Inner lip with nine strong sharp ridges which do not extend out over the body-whorl; deeply excavated below between the lowest ridge and a strong sinuous fold at the base of the columella.

Height, 19·5 mm.; width, 16·5 mm. (holotype).

Locality: Clifden, Band 4, Southland (holotype); Awamoa Creek, Collection of Dr. H. J. Finlay.

Holotype in Auckland Museum (Dr. H. J. Finlay's collection). Pl. 39, fig. 8.

Although badly crushed, the Awamoa Creek specimen seems to be identical with the Clifden shell.

Schilder, 1936 (*Proc. Malac. Soc.*, vol. 22, pt. 2, pp. 75–112) gives an excellent phylogenetic key to the Cypraeacea. He places *Trivia* and its allies in the Triviinae, a subfamily of the Eratoidae, and follows with the families Lamellariidae, Amphiperatidae and Cypraeidae, in that order.

Below is an attempt to locate the New Zealand Eratoids according to Schilder's classification. Species actually placed by Schilder are marked by an asterisk.

CYRAEACEA.

ERATOIDAE.

ERATOINAE.

Willungia Powell n.gen. Type: *Willungia tasmanica* Powell n.sp.

1. *Willungia fracta* (Tomlin, 1916).
2. *Willungia maoria* Powell n.sp.

Archierato Schilder, 1932. Type: *Erato pyrulata* Tate.

*3. *Archierato antiqua* (Marshall, 1919).
4. *Archierato accola* (Laws, 1935).

Proterato Schilder, 1927. Type: *Erato neozelanica* Suter.

Synonyms: *Sulcerato* Finlay, 1930. *Eratoena* Iredale, 1935. *Lachryma* (Sowerby) Iredale, 1935.

*5. *Proterato neozelanica* (Suter, 1917).
*6. *Proterato awamoana* Schilder, 1933 (n.n. for *E. neozelanica* Murdoch, 1924, *Trans. N.Z. Inst.*, vol. 55, pl. 10, f. 4, not of Suter, 1917) †
*7. *Proterato marshalli* (Marwick, 1929).
*8. *Proterato vulcania* (Marwick, 1926).
9. *Proterato waiauensis* (Laws, 1935).
10. *Proterato waitakiensis* (Laws, 1935).
11. *Proterato sepositum* (Laws, 1935).
12. *Proterato tenuilabrum* (Laws, 1935).
13. *Proterato clifdenensis* (Laws, 1935).
14. *Proterato pukeuriensis* (Laws, 1935).

Proterato (Cyprœrato Schilder, 1932). Type: *Erato bimaculata* Tate.

*15. *Proterato (Cyprœrato) senectus* (Murdoch, 1924).
16. *Proterato (Cyprœrato) submorosa* (Laws, 1935).

† Schilder, 1933, Monograph of the Subfamily *Eratoinae*, *Proc. Malac. Soc.*, vol. 20, p. 268.

CYMATIIDAE.

Genus MAYENA Iredale, 1917.

Type (orig. desig.): *Biplex australasia* Perry.

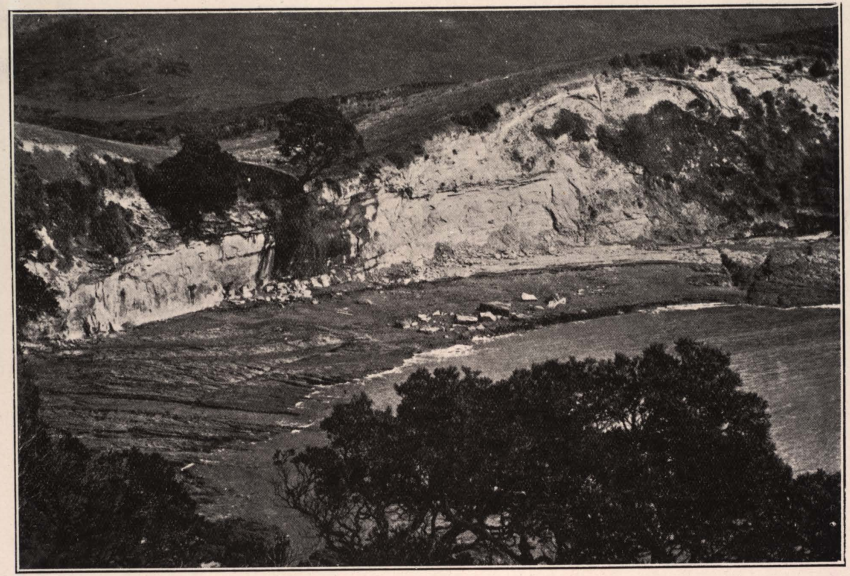
Mayena bartrumi n.sp. (Pl. 39, fig. 12.)

Shell of moderate size, fusiform; strongly variced at slightly more than half-whorl intervals. Spire slightly less than height of aperture plus the short canal. Nuclear whorls missing; post nuclear whorls 5. Sculpture of 3 equispaced rows of strong rounded nodules on the body whorl; on the spire, only the uppermost of these occurs and is placed medially; the second just shows at the suture towards

FIGS. 1 and 2.—*Eucrassatella ampla* (Zittel), Squadron Bay, Waiheke. FIG. 3.—*Eucrassatella attenuata* (Hutton), Target Gully, Oamaru. FIG. 4.—*Pteria oneroaensis* (Powell and Bartrum), Neotype. FIG. 5.—*Parapholas aucklandica* n.sp.: Holotype. FIG. 6.—*Parapholas aucklandica* n.sp.: Paratype. FIGS. 7 and 8.—*Cardium oneroaensis* n.sp.: Holotype. FIG. 9.—*Glycymeris (Grandaxinea) aucklandica* n.sp., Holotype. FIG. 10.—*Venericardia (Megacardita) squadronensis* n.sp., Holotype. FIGS. 11 and 12.—*Venericardia (Megacardita) squadronensis* n.sp., Paratypes.

To face page 372.

FIGS. 1 and 2.—*Sarmaturbo superbus* (Zittel), Operculum. FIG. 3.—*Magnatica (Spelaenacea) waitemataensis* n.sp., Holotype. FIG. 4.—*Willungia tasmanica* n.gen. and sp., Holotype, Table Cape, Tasmania. FIG. 5.—*Willungia ovulatella* (Tate), Topotype, Aldinga, S. Australia. FIG. 6.—*Willungia fracta* (Tomlin), Trelissick Basin, Canterbury. FIG. 7.—*Willungia fracta* (Tomlin), Squadron Bay, Waiheke. FIG. 8.—*Willungia maoria* n.sp., Holotype. FIG. 9.—*Willungia maoria* n.sp., Awamoa Creek. FIGS. 10 and 11.—*Euspinacassis onerosaensis* n.sp., Holotype. FIG. 12.—*Mayena bartrumi* n.sp., Holotype. FIG. 13.—*Scutellastra cooperi* n.sp., Paratype. FIG. 14.—*Scutellastra cooperi* n.sp., Holotype. FIG. 15.—*Cookia kawauensis* n.sp., Holotype. FIG. 16.—*Austrotoma finlayi* n.sp., Holotype. FIG. 17.—*Austrotoma finlayi* n.sp., Paratype. FIG. 18.—*Haliotis flemingi* n.sp., Holotype. FIG. 19.—*Haliotis (Notohaliotis) waitemataensis* n.sp., Holotype.



Fossiliferous bed half mile N.W. of Oneroa Beach, Waiheke Island. The original site described by Powell and Bartrum (1929).

the end of the penultimate whorl. There are six of these nodules between each pair of varices. On the early whorls and on the shoulder only of the later whorls there are numerous, somewhat irregular, narrow and flexuous axial folds. The whole shell, nodules included, is crossed by well-marked dense spiral striations. The varices are heavy rounded flanges very slightly buttressed from behind adjacent to the nodular rows, and margined at the front by the thin recurved edge of the outer-lip callus. Aperture narrowly ovate, notched above and with a short narrowly open straight canal below. Inner-lip callus broad and smooth with a small parietal tubercle and several weak denticles below. Outer lip reflected, weakly denticulate along the inner edge and terminating externally as a thin-edged flange separated from the labial varix by a deep narrow groove.

Height, 67 mm.; diameter, 35 mm. (holotype).

Holotype in the writer's collection, Auckland Museum.

Locality: Squadron Bay, Waiheke Island, Auckland. Collected by A. W. B. P.

This species is allied to *Cymatium kaiparaensis* Finlay, 1924, and *C. sculpturatum* Finlay, 1924, both of which were later referred to *Mayena* by their author (*Trans. N.Z. Inst.*, 57, p. 400).

The new species is characterised by having blunt tubercles combined with fine subsidiary spirals.

Genus PROXICHARONIA nov.

New name for *Charoniella* Powell and Bartrum, 1929 (not *Charoniella* Thiele, 1929, *Handb. Syst. Weicht.*, I, p. 283).

Type: *Charonia (Charoniella) arthritica* Powell and Bartrum.

Proxicharonia arthritica Powell and Bartrum, 1929.

1929. *Charonia (Charoniella) arthritica* Powell and Bartrum, *Trans. N.Z. Inst.*, vol. 60, p. 445.

Unfortunately the name *Charoniella,* proposed as a subgenus of *Charonia* by Powell and Bartrum for the Waiheke species *arthritica,* is invalidated by Thiele's use of the same name for an Australian species *Triton subdistortus* Lamk. Iredale's genus *Negyrina* 1929 (September 4th) proposed for the same Australian shell, has slight priority over Thiele's *Charoniella,* but as Powell and Bartrum's proposal did not appear until November 30th, it is necessary to provide a new name for the New Zealand *Charoniella.*

The local *Charoniella* was proposed as a subgenus of *Charonia,* to which it is distantly related, but the three species ascribed to it by its authors form such a compact group (each having the characteristic distorted growth discordant with *Charonia* and reminiscent of *Distorsio*) that full generic rank is desirable.

A second specimen was found at Squadron Bay, Waiheke Island.

CASSIDIDAE.

Genus EUSPINACASSIS Finlay, 1926.

Type (orig. desig.): *Euspinacassis pollens* Finlay.

Euspinacassis oneroaensis n.sp. (Pl. 39, figs. 10 and 11.)

Shell of medium size, massive, encircled with numerous rows of strong blunt tubercles; aperture heavily variced and calloused within; canal very short, deeply notched. Apex erect, dome-shaped, of three smooth regularly-coiled whorls, nucleus minute. Spire one-fourth height of aperture. Five spiral rows of nodules on the body-whorl, only the uppermost showing on the spire-whorls. Between the lowest spiral row of nodules and the fasciole are three flat-topped subsidiary spiral cords without nodules. The nodules on the uppermost spiral number eleven on the body-whorl; they are subspinose; those on the lower spirals number fourteen, and are bluntly rounded. Whole surface overlaid with fine crowded spiral lirations. Aperture narrowly ovate. Outer lip with a very heavy varix, reflexed, and bearing weak denticles along the calloused inner edge. Parietal callus thick and spreading, with irregular plait-like ridges on the pillar, and bridging across the deep umbilical chink.

Height, 44 mm.; diameter, 31 mm. (holotype).

Locality: Oneroa, Waiheke Island (small bay ½ mile N.W. of Oneroa Beach).

Holotype in the writer's collection, Auckland Museum.

This species is nearest allied to *Xenophalium toreuma* Powell, 1928 (*Trans. N.Z. Inst.*, 59, p. 636) from volcanic tuffs at Motutara, West Coast, Auckland, and appears to be directly ancestral to it. The Waiheke species differs from *toreuma* in having a shorter spire with only the uppermost row of nodules showing on the spire whorls.

Rutsch ("Zur Nomenklatur und Systematischen Stellung einiger tertiarer Cassididae aus Neu-Seeland," Sonderabd. aus dem Ber. uber die elfte Jahresversammlung der Schweizerischen Pal. Gessell., *Eclogae geologicae Helvetiae,* Band 24, No. 2, p. 252, 1931) synonymises Finlay's *Euspinacassis* with the European Tertiary *Echinophoria* Sacco, 1890, and at the same time expresses the view that *Echinophora* Leske, 1778, does not invalidate Sacco's *Echinophoria.* I hesitate to accept Rutsch's conclusions without having access to specimens of the genotype of *Echinophoria* Sacco.

MURICIDAE.

Genus VESANULA Finlay, 1926.

Type (orig. desig.): *V. chaskanon* Finlay.

Vesanula waitemataensis (Powell and Bartrum, 1929).

1929. *Zeatrophon waitemataensis* Powell and Bartrum, 1929, *Trans. N.Z. Inst.*, vol. 60, p. 436.

Better preserved material has necessitated a change to the above genus, as suggested to the writer by Dr. H. J. Finlay.

NASSARIIDAE.

Genus HIMA Gray, 1852.

Type (Woodring, 1928): *Buccinum minutum* Pennant (= *B. incrassatum* Strom.).

Subgenus MIRUA Marwick, 1931.

Type (orig. desig.): *Nassa socialis* Hutton.

Hima (Mirua) aff. **socialis** (Hutton, 1886).

A single specimen from Squadron Bay cannot be removed from the matrix with safety. It is close to *socialis*, but has the axial ribs more numerous on the last whorl.

TURRIDAE.

Genus RUGOBELA Finlay, 1924.

Type (orig. desig.): *Ptychatractus tenuiliratus* Suter.

Rugobela sepelibilis (Powell and Bartrum, 1929).

1929. *"Guraleus" sepelibilis* Powell and Bartrum, *Trans. N.Z. Inst.*, vol. 60, p. 441.

This species should now be referred to the above genus.

Genus AUSTROTOMA Finlay, 1924.

Type (orig. desig.): *Bathytoma excavata* Suter.

Austrotoma finlayi n.sp. (Pl. 39, figs. 16 and 17.)

1929. *Austrotoma excavata* (Suter), Powell & Bartrum, not of Suter, 1917.

I am indebted to Dr. H. J. Finlay for the opinion that the 1929 record of *"excavata"* from Oneroa is not that species, but a new one closely related to a new species from Otiake, Waitaki Valley. True *excavata* is almost smooth and more inflated medially.

The Waiheke species is distinguished by its slender shape and tall spire, which equals the aperture in height. The paratype (pl. 38, fig. 17) shows the normal proportions of spire to aperture, while the holotype (pl. 38, fig. 16) exhibits the sculpture very clearly. The extra long spire of the holotype is the result of lateral squeezing in the matrix.

Description of holotype. Shell rather large, narrowly fusiform; spire normally not quite as high as aperture plus canal. Whorls 10, including a typical, conoid, small, smooth, multispiral protoconch of three whorls, followed by a half whorl bearing 8 fine spirals. Spire whorls strongly angled and keeled at a little below the middle, shoulder deeply concave. Sculpture of well-defined, flat-topped, spiral cords with a fine thread in each interspace. The main spirals number two on the upper whorls and three on the lower whorls, between the broad rounded keel and the lower suture. The keel may be smooth, but more often it is as in the holotype, composed of three more closely spaced additional spirals. Between the peripheral keel and the upper suture there are seven finer cords, the middle four being weaker than the pairs above and below them respectively.

On the body-whorl there are fifteen main cords below the keel. The axial sculpture consists of fourteen weak axial folds, which disappear after the fourth post-nuclear whorl. Fasciole distinct, bounded by a thin sharply raised cord and sculptured with six spiral threads, the upper three being the stronger.

Height, 57 mm.; diameter, 19 mm. (estimated), 21·5 mm. (actual: specimen crushed) (holotype).

Height, 45 mm. (estimated); diameter, 18·5 mm. (paratype).

Holotype in writer's collection, Auckland Museum.

Locality: Oneroa.

VOLUTIDAE.

Genus WAIHAOIA Marwick, 1926.

Type (orig. desig.): *W. allani* Marwick.

Waihaoia n.sp.

Two badly crushed specimens allied to *phymatius* (Finlay, 1926) were found at Squadron Bay, Waiheke Island, but this material is barely sufficient for the founding of a new species. The Waiheke shells have the same sparse enlarged tubercles as *phymatius*, but the spire is much shorter and the local shells attain a larger size.

MOLLUSCA FROM TERTIARY BED EAST SIDE OF BOSTAQUET BAY, KAWAU ISLAND.

W = found also in the Waiheke faunules.

Class PELECYPODA.

Class GASTEROPODA.

Pallium burnetti (Zittel, 1864).

Ostrea (Gigantostrea) gittosina Powell and Bartrum, 1929.

W. *Eucrassatella ampla* (Zittel, 1864).

W. *Venericardia (Megacardita) squadronensis* n.sp.

Miltha (Milthoidea) dosiniformis Marshall and Murdoch, 1921.

*Divalucina** aff. *cumingi* (Ad. and Ang.).

W. *Cardium (Trachycardium) greyi* Hutton, 1873.

Haliotis (Notohaliotis) waitemataensis n.sp.

Haliotis (Notohaliotis) flemingi n.sp.

Astraea n.sp.

Cookia kawauensis n.sp.

W. *Sarmaturbo superbus* (Zittel, 1864).

W. *Zegalerus* cf. *peramplus* Powell and Bartrum, 1929.

W. *Struthiolaria* spec. indet. (prob. *lawsei* Powell & Bartrum, 1929).

W. *Morum (Oniscidia) harpaformis* Powell and Bartrum, 1929.

* Iredale, 1936, *Rec. Aust. Mus.*, vol. 19, no. 5, p. 273.

HALIOTIDAE.

Genus HALIOTIS Linné, 1758.

Type (subsequent designation, Montfort, 1810): *Haliotis asinina* Linn.

Subgenus NOTOHALIOTIS Cotton and Godfrey, 1933.

Type (original designation): *Haliotis naevosa* Martyn.

Haliotis (Notohaliotis) waitemataensis n.sp. (Pl. 39, fig. 19.)

Shell of moderate size, ovate, much depressed; sculptured with imbricating strong radial folds crossed by spiral cords of three sizes. On the penultimate whorl there are five well-defined equispaced cords which increase in strength and persist over the body-whorl. Intermediates commence after the first post-nuclear whorl, there being in each of the interspaces between the main ribs a subsidiary median rib with a finer rib in the interspace on each side of it. The radials and the main spirals are five millimetres apart respectively at the middle of the body-whorl. Space between perforations and lower margin of shell spirally ribbed, but the number is indefinite owing to adherent matrix. Protoconch worn, one-third of the length from the left margin and less than a third of the width from the front margin. Perforations distinctly raised, tubular, and numbering about 21 on the body-whorl.

Length, 56 mm.; width, 46 mm.; height (estimated), 17 mm. (holotype).

Holotype in the writer's collection, Auckland Museum.

Locality: East side of Bostaquet Bay, Kawau Island, in sandy limestone. Collected by A. W. B. P.

The indeterminable specimen recorded from Oneroa, Waiheke Island, by Powell and Bartrum (1929, *Trans. N.Z. Inst.*, 60, p. 445), but not collected, was probably this species.

Haliotis flemingi n.sp. (Pl. 39, fig. 18.)

Shell of moderate size, ovate, depressed; sculptured with somewhat irregular arcuate forwardly directed radial folds. There appears to be no spiral sculpture. There are fourteen of the radial folds on the last whorl. Nucleus at about one-third of the length from the left margin (allowance being made for slight distortion of the specimen). Perforations slightly raised, 14 on the last half-whorl. Space between perforations and lower margin of shell appears smooth.

Length, 78 mm.; width, 55 mm.; height (estimated), 19 mm. (holotype).

Holotype presented to the Auckland Museum by Mr. C. A. Fleming.

Locality: East side of Bostaquet Bay, Kawau Island, in sandy limestone. Collected by Mr. C. A. Fleming, 1934.

This species is ancestral to the Recent *australis* Gmelin, from which it differs in the absence of spiral sculpture, fewer radials, and the nucleus being nearer to the middle.

The two species described above are of special interest, as they make the earliest known occurrence of *Haliotis*. Probably the genus is of much greater antiquity, for rock-clinging organisms are very rarely preserved as fossils. Woodring, 1931, and 1932, records two Miocene species from California, and there are several Australian Tertiary species from Miocene localities.

TURBINIDAE.

Genus Astraea Bolten, 1798.

Type (desig. by Suter, 1913): *Trochus heliotropium* Martyn.

Astraea n.sp.

This is a new species differing from the genotype in being much more depressed, more sparsely sculptured and in having bluntly-rounded peripheral processes and a very shallow umbilicus. Unfortunately, the available material is inadequate for providing a recognisable description.

Locality: East side of Bostaquet Bay, Kawau Island.

Material in Auckland Museum collection (1 sp.) and the writer's collection (2 sps.).

Genus Cookia Lesson, 1832.

Type (*monotypy*): *Astralium sulcatum* Martyn.

Cookia kawauensis n.sp. (Pl. 39, fig. 15.)

Shell large, conic, probably imperforate. Whorls probably seven (only five showing owing to eroded apex). Sculpture of strong, oblique, forwardly-directed, flexuous, rounded, fold-like axials, each terminating at the lower suture or periphery in blunt massive tubercles. These axials are about sixteen per whorl. Encircling the middle of each whorl is a slightly depressed zone caused by the axials being reduced in strength medially. Suture deeply impressed, undulating.

Height, 73 mm.; diameter, 80 mm. (estimated).

Locality: East side of Bostaquet Bay, Kawau Island. Collected by A. W. B. P., 1927.

Holotype in writer's collection, Auckland Museum.

The holotype, the only specimen collected, is very imperfect, but is named, as nothing much better is likely to be found in the Kawau beds. It is of interest also to record a Tertiary ancestor to the Recent species.

Mollusca from Tertiary Bed on South Side of Motuihi Island.

PECTINIDAE.

Genus Serripecten Marwick, 1928.

Type (orig. desig.): *Pecten hutchinsoni* Hutton.

Serripecten beethami (Hutton, 1873).

One fairly complete right valve of medium size (height, 69 mm.; length, 80 mm.).

PATELLIDAE.

Genus SCUTELLASTRA H. & A. Adams, 1858.

(Three species cited: *gorgonica* Humph., *pentagona* Born, and *plicata* Born.)
Type (here selected): *Patella gorgonica* Humph. = *P. longicosta* Lamk.

Scutellastra cooperi n.sp. (Pl. 39, figs. 13 and 14).

Shell fairly solid, depressed, star-shaped, having eight principal ribs, which are carinated and strongly projecting at the margins. There are from three to five secondary rounded ribs in the interspaces between the primaries. Apex (eroded away) at about the anterior third. Margins strongly indented between the primary ribs.

Length, 50 mm.; breadth, 38 mm.; height, approx. 9 mm. (holotype), (pl. 38, fig. 14).

Locality: Motuihi Island, midway along the south coast, Auckland. Collected by the late Mr. Charles Cooper.

Holotype and paratype in the Charles Cooper Collection, Auckland Museum.

This species, although represented by very imperfect material, is almost certainly a *Scutellastra,* closely resembling the South African *longicosta* group. The few carinate ribs, with deeply indented margins, are characters foreign to any *Cellana* known to me; and, further, typical species of *Cellana* occur in local beds of the same horizon.

Scutellastra is considered to be a genus of considerable antiquity, and its present wide distribution in the Southern Hemisphere is interpreted as providing some indication of the probable extent of the hypothetical " Gondwanaland " continent of geologists. Recent species of *Scutellastra* have their greatest development in South Africa, but others occur at Mauritius, Reunion, South Western Australia, Philippine Islands, Melanesia, Polynesia, and the Kermadecs. As far as I am aware, no fossil species is on record, and a genus is hereby added to the New Zealand Tertiary fauna.