New Tertiary Mollusca from New Zealand.

No. 1.

By C. R. LAWS, M.Sc., Teachers' Training College, Dunedin.

[*Read before the Otago Institute, 12th August, 1930; received by Editor, 15th August, 1930; issued separately, 25th November, 1930*].

PLATES 88-91.

WITH the exception of two shells—*Cardium strangi* n. sp. and *Verconella finlayi* n. sp.—the Mollusca described in this paper have been recently collected by the writer. His sincere thanks are due to Dr. H. J. Finlay and to Dr. J. Marwick for assistance in identification, and also to Dr. W. N. Benson for permission to describe the very fine new species of *Cardium* from Chatton.

Genus **Glycymeris** Da Costa, 1778.
Type *Arca glycymeris* Linné

Glycymeris marshalli n. sp. (Figs. 13, 14).

Shell large, light of build for its size, inflated, beaks low. Outline very oblique; the line joining the apices of the chevrons (four in number) on the ligamental area correspondingly oblique. Shoulders high, little sloping. Anterior winged dorsally and descending rapidly at first, but later retreating more postero-ventrally. A fairly strong ridge running from the umbo intersects the posterior margin just below its middle forming a rounded angle. Above this the descending dorsal half of posterior margin runs postero-ventrally, thereafter inclining antero-ventrally. Sculpture of numerous flat radial ribs separated by almost linear grooves, not on the posterior wing, where, however, a hand lens shows fine, closely-spaced radial striations, found also on the anterior dorsal surface, but not seen elsewhere no doubt as a result of the partially decorticated state of the shell. Teeth numerous and light, 6 to 7 fully developed on each side of ligamental area.

Height, 74 mm.; length, 69 mm.; inflation 20 mm.

Locality—Shell Gully, Chatton, near Gore, Southland (Ototaran).

Holotype and two broken paratypes in writer's collection.

The build of shell, hinge characters and sculpture show that this species has affinities with shells of the "*Axinea*" group, as used by Marwick (*Trans. N.Z. Inst.*, vol. 54, p. 64; 1923).

Genus **Dosinia** Scopoli, 1777.
Type *D. africana* Hanley.
Subgenus **Raina** Marwick, 1927.
Type *D. bensoni* Marwick.

Dosinia (Raina) benereparata n. sp. (Figs. 2, 3).

Shell large, moderately inflated, slightly higher than long, drawn down postero-ventrally; beaks situated at about anterior third; dor-

sal margin well arched up. Lunule long, lanceolate, fairly well impressed; escutcheon well marked and moderately deep. Hinge-plate not quite as wide and heavy as in *bensoni,* arched up especially behind posterior cardinal tooth. Dentition closely similar to that of the type of the subgenus but posterior cardinal somewhat more lamellar, anterior lateral higher and narrower and median cardinal perhaps not quite so unevenly divided. Sculpture of unevenly-spaced concentric ridges, crowded together closely towards ventral margin. Pallial sinus moderately deep, sharp and directed towards lower third of anterior adductor. Base of adductor scars just about at middle horizontal line of shell, whereas those of *bensoni* extend well below that line.

Height, 54 mm.; length, 50 mm.; thickness (one valve), 14 mm.

Locality—Shell Gully, Chatton, Southland (Ototaran).

Holotype and a broken paratype in writer's collection.

As the writer found difficulty in referring this and the following species to their subgenera he forwarded them to Dr. J. Marwick for examination. Dr. Marwick places them both in *Raina,* and states concerning the present shell that it is relatively higher than *bensoni,* the pallial sinus is directed much lower than usual in *Raina* and the anterior lateral tooth is high and narrow.

Dosinia (Raina) bartrumi n. sp. (Figs. 5, 7).

A large, heavily-built, inflated and orbicular shell. In dentition (left valve) and sculpture strongly reminiscent of *R. nukumaruensis* Marwick, but left median cardinal is wider and the lunule is not quite so impressed and is relatively longer in Dr. Marwick's species. Escutcheon well developed and deep. Pallial sinus directed towards middle of anterior adductor (thus agreeing more with *nukumaruensis* than with *bensoni,* but not so low as in the previously described species), acute and reaching about half-way across valve. At intervals of about 5 mm. one of the concentric ridges, which over the entire valve are fine and densely packed together, is more prominent than the others, standing out in somewhat more marked relief where there has been slight abrasion of the surface.

Height, 65 mm.; length, 64 mm.; thickness (one valve), 23 mm.

Locality—Kaawa Creek Beds, West Coast, South of Waikato Heads (Waitotaran).

Type (a single left valve) in writer's collection.

Of this shell Dr. Marwick writes, "Inflation greater than in any other *Raina.* Lunule relatively short and more impressed than usual. *R. nukumaruensis* is fairly well inflated and has a slightly more impressed lunule than *bensoni;* but has not so deep an escutcheon, a narrower left median cardinal and a large anterior lateral."

Named in honour of Professor J. A. Bartrum, who first discovered the fossiliferous Kaawa Creek Beds, in recognition of the kindly assistance he has always been ready to give the writer over a number of years.

Genus **Cardium** Linné, 1758.

Type *Cardium costatum* Linné.

Cardium strangi n. sp. (Figs. 6, 9).

Shell large, oblique, drawn out postero-ventrally, inflated; anterior end convex, posterior end flattened; beaks at about anterior third, incurved, flattened in the plane of the hinge, directed forward. Posterior margin parallel with antero-ventral margin, produced and angled below. Ventral margin convex, ascending more in front, strongly and sharply dentate. Sculpture of about 50 broad, regular radial ribs, which tend to be somewhat flattened over most of the shell, but are more or less ridged and nodular towards basal margin; ribs separated by deep, linear grooves. On the posterior flattened area the ribs are ill-formed, the interstices wider and shallower. Growth-lines weakly defined towards ventral margin, but strongly shown undulating across the weaker ribs and grooves of the ventral part of flattened posterior area. As a result of decortication towards the beaks the radials stand out clearly, separated by flat-floored grooves whose width is sub-equal to that of the ribs. The whole are crossed by a system of fine, slightly wavy striae, about 6 to 8 per mm., those in the grooves faintly convex ventrally, those on the ridges convex dorsally. Muscular impressions strongly incised, the posterior one the larger, pedal retractor scar separate, large and elongate dorso-ventrally, hidden by hinge-plate. Hinge with two cardinal teeth, the dorsal one slightly anterior to beak and a little elongated in a direction parallel with the dorsal part of the anterior margin. The lower cardinal much larger, resembling a conical peg protruding from hinge-plate, slightly behind the beaks. Cardinals separated by a channel opening into a deep pit anterior to the lower cardinal. There are two anterior laterals, placed vertically one above the other and separated by a broad, deep pit; upper one low, elongated horizontally; lower one high, conical, pointed. Posterior lateral tooth near remote end of hinge-plate, rising abruptly from its ventral margin and with a broad pit running from above it postero-ventrally to the end of hinge-plate. Nymph broad and strong.

Height, 95 mm.; length, 105 mm.; thickness (one valve), 38 mm.

Locality—Shell Gully, Chatton, near Gore, Southland (Ototaran).

Holotype (a single right valve) in the collection of the University of Otago.

This species has affinities with *C. spatiosum* Hutton, and is allied to an undescribed species from Clifden, Southland, in the collections of Dr. H. J. Finlay and of the University of Otago.

Named in honour of its discoverer, Mr. D. U. Strang, of Invercargill.

Genus **Elachorbis** Iredale, 1915.

Type *Cyclostrema tatei* Angas.

Elachorbis albolapis n. sp. (Figs. 10, 11).

Shell very small, perforate, discoidal, turbinate. Protoconch of about 2½ smooth turns; whorls about 4, ornamented by strong,

sharply-elevated, regular spirals, spaced evenly, especially over the base, but interval between the third and fourth from suture of body whorl greater and almost twice that of others. Interspaces considerably wider than the ridges. Spirals visible on the coils within the wide, perspective umbilicus; about 18 on body whorl, the first two below suture weaker than the others, the ninth stronger, forming a slight angle separating the upper convex part of whorl from the slightly flattened base. Spirals seen through light callus of inner lip and within aperture; 4 on penultimate whorl. Aperture almost circular, sharp, shining within and corrugated outside by the spiral sculpture. There is a shallow infrasutural furrow bounded below by the strengthened third spiral.

Height, about 1.5 mm.; diameter, 3 mm.

Locality—White Rock River shell bed (Awamoan), South Canterbury.

Type in writer's collection (one shell).

This is the second species of *Elachorbis* described from White Rock River, which is the type locality for *E. helicoides* (Hutton). The writer recently collected *E. politus* (Suter) there also. Its strong, regular corrugations at once separate it from the latter species, and this feature combined with the absence of keels readily distinguishes it from Hutton's shell and from *E. duplicarina* Marwick from Chatton. In sculpture it approaches *E. cingulatus* (Bartrum) from the Pliocene beds at Kaawa Creek, and an allied undescribed species in the writer's collection from Hawkes Bay, but in these the whorls are more evenly convex and no spirals ornament the umbilicus.

Genus **Modelia** Gray, 1840.

Type *Turbo granosus* Martyn.

Modelia nukumaruensis n. sp. (Fig. 8).

Shell not large, very thick and solid for its size, imperforate, with strong spiral ornament. Sculpture consists of equally strong, well-spaced spiral lirae, the interstices of about the same width as the spirals, which bear smooth, evenly-spaced granules. The first spiral below the suture is markedly weaker than the others, and is separated from the second spiral by an interval wider than those between the others. The penultimate whorl has nine spirals (twelve in *granosa*). On the base the spiral ornament becomes somewhat sharper, the width of the interspaces increases to about twice that of the ridges, the granular character of which becomes less noticeable (the bases of two juvenile paratypes from Kai Iwi are entirely devoid of granules). Below the periphery of the body whorl several weak cinguli appear in the interstices emerging from beneath the callus of the inner lip, and these enlarge spirally towards the outer lip. Fine, dense growth-lines trend obliquely across the interstices and are visible also on the inter-granular saddles of the lirae (as in *granosa* Martyn). The early sub-nuclear whorls carry a fenestrated ornament due to low, somewhat oblique axials connecting the granules of the spirals. Protoconch (juvenile from Kai Iwi) smooth

and of about two whorls. Earliest whorls only lightly convex, but later ones become progressively more rounded; base convex. Aperture somewhat quadrate, not so oblique as in *granosa* Martyn. Outer lip sharp. Columella concave, oblique, iridescent.

Height, 18 mm.; diameter, 15 mm.; height of spire, 10 mm.

Locality—Pliocene beds of Kai Iwi (Castlecliffian), and Nukumaru (Nukumaruan).

Holotype (Nukumaru) and two juvenile paratypes (Kai Iwi) in writer's collection.

Readily distinguished from *granosa* Martyn by its smaller size, higher spire, less distended and less oblique aperture, and fewer and more regular spirals.

Finlay (*Trans. N.Z. Inst.*, vol. 57, pp. 366-7; 1927) drew attention to the fact that no Tertiary ancestors of *Modelia and Lunella* were up to that time known, stating that this was certainly due to the almost total lack of quite littoral fossil deposits in New Zealand, for the ancestors of such distinct shells must certainly have lived in the same locality. In 1928, however, Professor J. A. Bartrum and the writer collected several specimens of the new species from the mid-Pliocene beds at Nukumaru and at Kai Iwi, while still more recently Powell and Bartrum (*Trans. N.Z. Inst.*, vol. 60, p. 413; Pl. 42, Fig. 63; 1930) describe and figure a shell allied to *granosa* Martyn, which they collected from beds of the Waitemata Series at Oneroa, Waiheke Island, the shallow-water facies of which is shown, as these writers point out (*loc. cit.*, p. 396), by the presence therein of such genera as *Haliotis, Cellana, Bembicium, Lepsiella, Pyrazus, Bankia.*

Genus **Sinum** Roeding, 1798.

Type *Helix haliotoidea* Linné.

Sinum marwicki n. sp. (Figs. 1, 4).

Shell small, greatly depressed; whorls nearly three including a smooth, planorboid protoconch of one and a-half whorls; last whorl enlarging fairly rapidly; apex excentric and nearer front edge; spire flat, about one-fifth height of shell, and dorsal surface convex; body whorl lightly excavated ventrally between inner edge of aperture and outer margin of base, the concavity becoming more marked towards the small, partly hidden umbilicus. The upper surface has slightly undulating, somewhat flattened spiral threads, about 35 in number (3 per mm.), separated by grooves slightly wider than the ridges. Towards the periphery the last ten or so lirae suddenly become finer and the width of the interstices less in relation to that of the ridges. These are crossed by well-defined convex growth-lines. No spirals are developed on the base, but the lines of growth are prominent as they sweep convergingly into the umbilical tract. Suture markedly tangential. Aperture large, circular, nearly two-thirds greatest diameter of shell, angled above. Outer lip thin and strongly convex; inner lip covering parietal wall (callus partially broken away in specimen), reflexed and partly hiding umbilicus.

Height, 5 mm.; greatest diameter, 14 mm.; least, 11 mm.

Locality—White Rock River shell bed (Awamoan), South Canterbury.

Holotype (the only specimen) in the writer's collection.

This is the third species of *Sinum* s. str. described from the Tertiary of New Zealand. It is not unlike *S. infirmum* Marwick from the Awamoan beds of Ardgowan and Pukeuri, but is readily separable on account of its less excentric apex and more compressed character, causing a sharper periphery to the body whorl, which also enlarges less rapidly in the new species than it does in *S. infirmum.**

Genus **Verconella** Iredale, 1914.

Type *Fusus dilatatus* Q. and G.

Verconella finlayi n. sp. (Figs. 12, 15).

Closely allied and probably ancestral to *V. marwicki* Finlay (*Trans. N.Z. Inst.*, vol. 61, p. 67; Pl. 2, Figs. 15 and 16), which it resembles in detail of sculpture and general build of shell, but it differs at sight in its less slender and less graceful outline. Spire relatively shorter than that of *marwicki*, but wider at base, so that it rises less steeply; spire 2½ times height of aperture plus canal, whereas in *marwicki* it is slightly over twice the height of aperture plus canal. Tubercles, especially those on body whorl, placed less than their own width apart, 10 on penultimate and 11 on body whorl. Periphery even lower than in *marwicki*, the suture undulating over the tubercles and on the penultimate whorl almost covering them. Shoulder of body whorl a good deal more excavated than that of the Mt. Harris shell.

The following are measurements taken in comparing shells of the same length, the specimen of *V. marwicki* being a topotype (Mt. Harris):

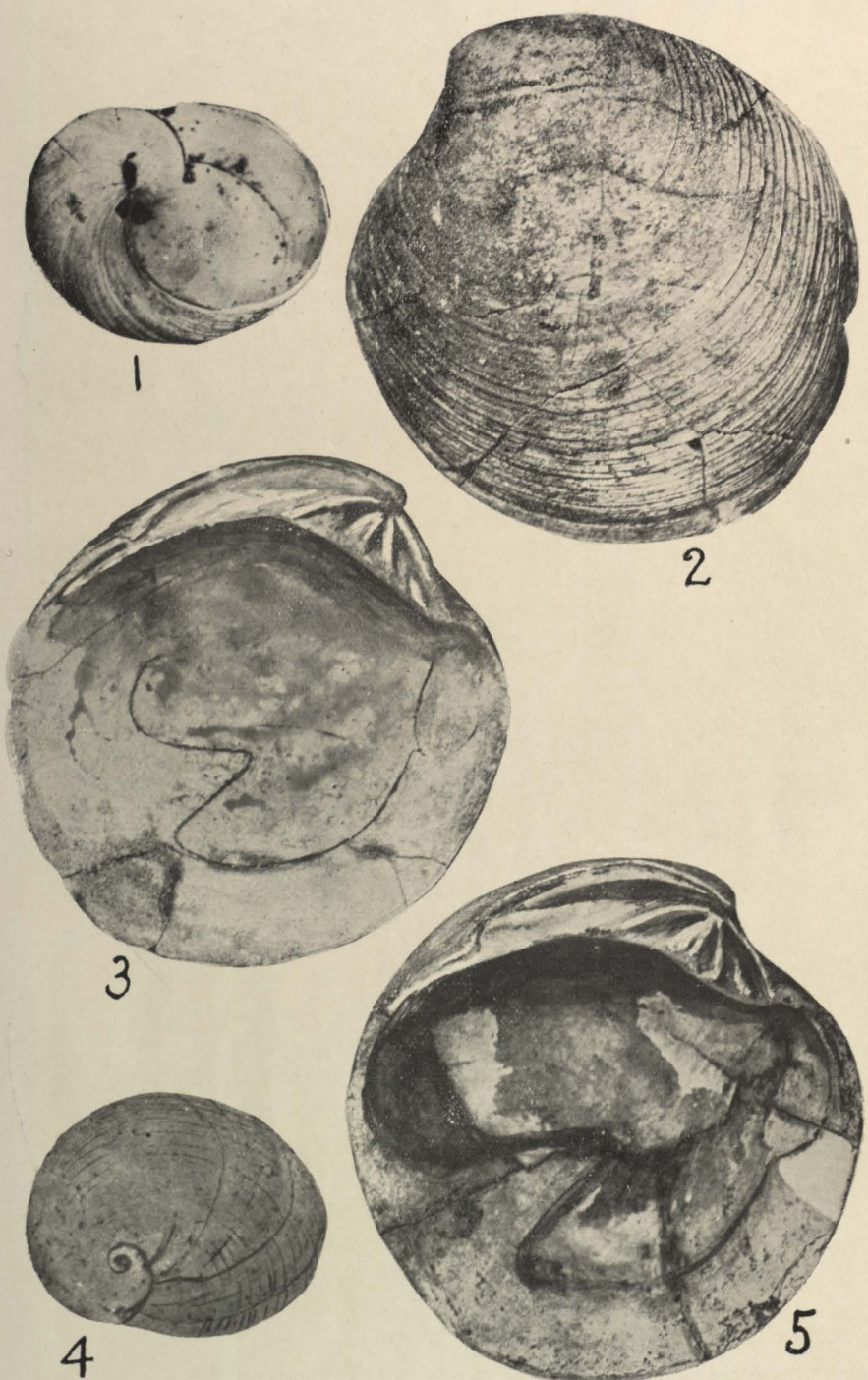
	marwicki	*finlayi*
Length	98 mm.	98 mm.
Height of spire	33 mm.	31 mm.
Width of body whorl	55 mm.	60 mm.
Length of suture of body whorl	95 mm.	109 mm.
Angle of spire	68°	80°

Locality—Blue Cliffs, South Canterbury, sandy clays above limestone (Hutchinsonian). Collected by Dr. P. Marshall.

Holotype (unique) in writer's collection.

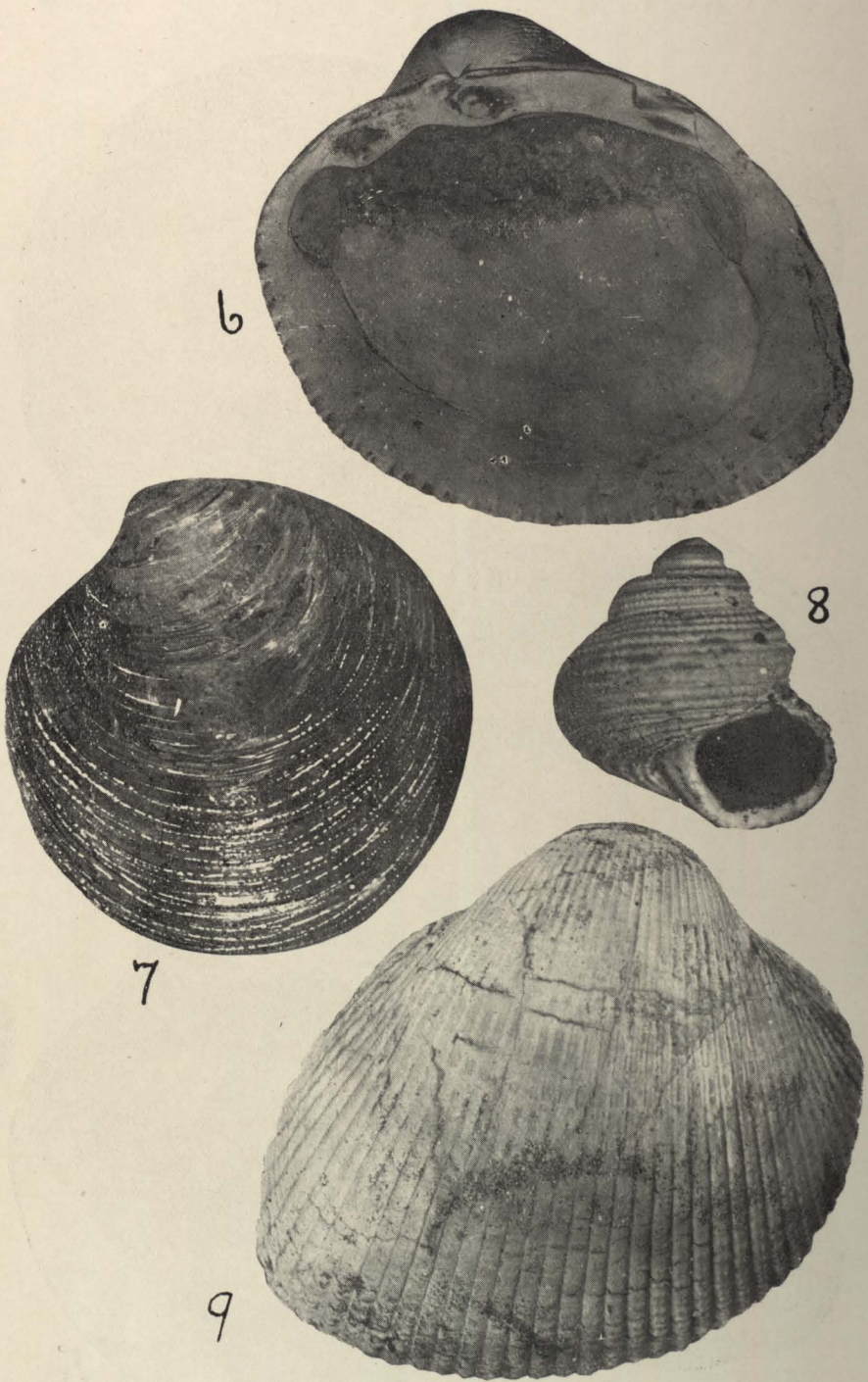
Separable at sight from *V. marwicki* by the relatively greater width of the last whorl, with its more excavated shoulder, greater angle of spire and lower periphery to whorls.

* Since the above was written the writer has collected a perfectly preserved topotype of *S. infirmum* Marwick, its dimensions being slightly less than those given for the holotype.

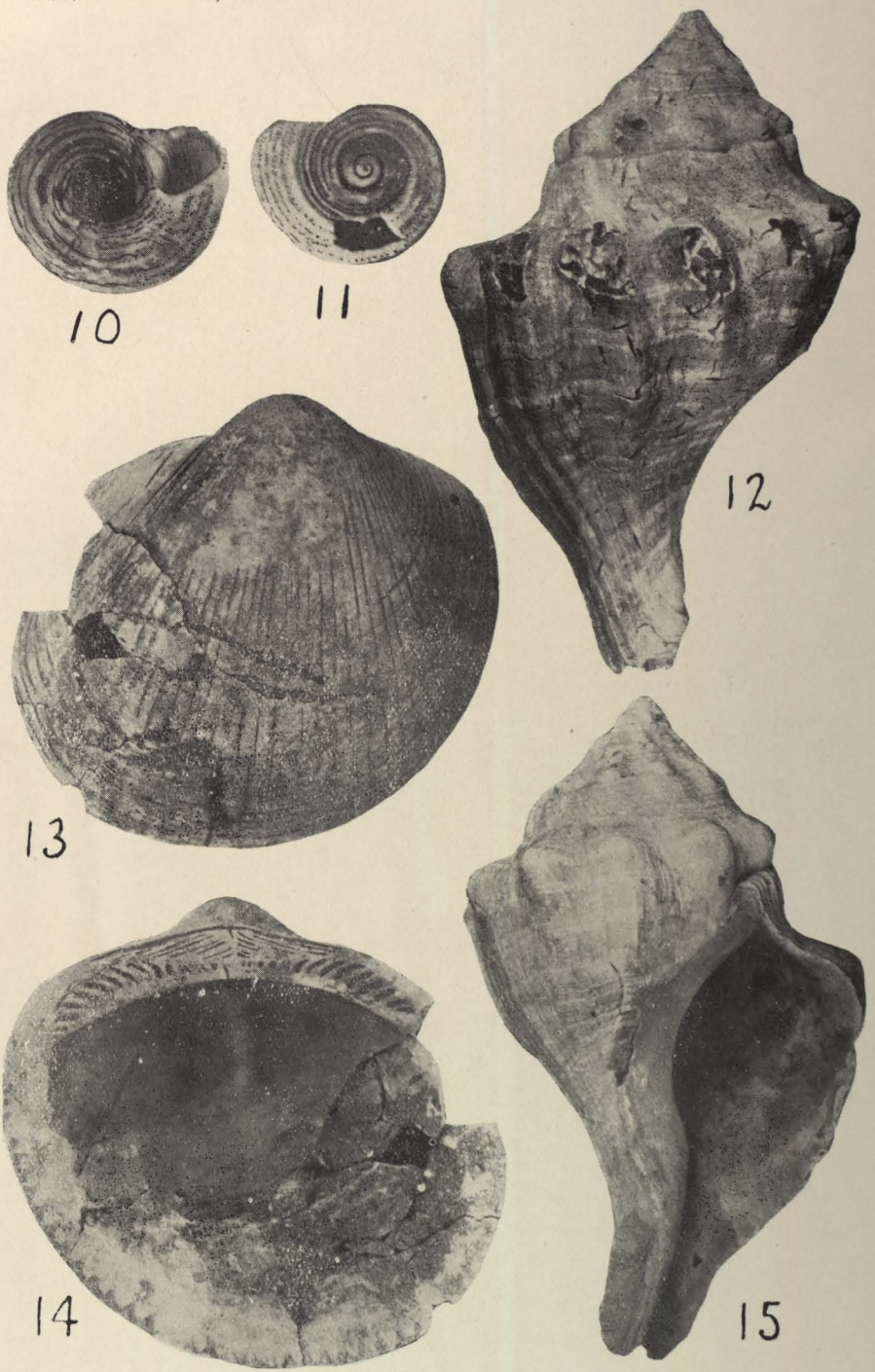


FIGS. 1, 4.—*Sinum marwicki* n. sp.: holotype, × 3.
FIGS. 2, 3.—*Dosinia* (*Raina*) *benereparata* n. sp.: holotype, × 1.2.
FIG. 5.—*Dosinia* (*Raina*) *bartrumi* n. sp.: holotype, × 1.1.

Face p. 552.



FIGS. 6, 9.—*Cardium strangi* n. sp.: holotype, × 0.8.
FIG. 7.—*Dosinia* (*Raina*) *bartrumi* n. sp.: holotype, × 1.
FIG. 8.—*Modelia nukumaruensis* n. sp.: holotype, × 2.2.



FIGS. 10, 11.—*Elachorbis albolapis* n. sp.: holotype, Fig. 10 × 10.
FIGS. 12, 15.—*Verconella finlayi* n. sp.: holotype, × 0.9.
FIGS. 13, 14.—*Glycymeris marshalli* n. sp.: holotype, × 0.9.

This is another species of the *marwicki-adusta* line, discussed by Finlay (*Trans. N.Z. Inst.*, vol. 61, pp. 67-70). In its very low periphery and almost straight spire whorls the new species resembles a specimen (in the writer's collection) of *V. affixa* Finlay from Clifden, band 6 B. The differences in sculpture, however, between *marwicki* and *affixa*, noted by Finlay (*loc. cit.*, p. 69), exist also between the latter species and that described above.

The writer has pleasure in associating this shell with Dr. H. J. Finlay, who has given him a great deal of assistance and advice in molluscan matters generally.

LITERATURE REFERRED TO.

BARTRUM, J. A., 1919. New Fossil Mollusca, *Trans. N.Z., Inst.*, vol. 51, pp. 96-100.

FINLAY, H. J., 1924. Additions to the Recent Molluscan Fauna of New Zealand, *Trans. N.Z. Inst.*, vol. 55, pp. 517-526.

—— 1926. A Further Commentary on New Zealand Molluscan Systematics, *Trans. N.Z. Inst.*, vol. 57, 1927, pp. 320-485.

—— 1930. New Shells from New Zealand Tertiary Beds; Part 3, *Trans. N.Z. Inst.*, vol. 61, pp. 49-84.

MARWICK, J., 1923. The Genus Glycymeris in the Tertiary of New Zealand, *Trans. N.Z. Inst.*, vol. 54, pp. 63-80.

—— 1924. The Tertiary and Recent Naticidae and Naricidae of New Zealand, *Trans. N.Z. Inst.*, vol. 55, pp. 545-579.

—— 1927. The Veneridae of New Zealand, *Trans. N.Z. Inst.*, vol. 57, pp. 567-635.

—— 1929. Tertiary Molluscan Fauna of Chatton, Southland, *Trans. N.Z. Inst.*, vol. 59, pp. 903-934.

POWELL, A. W. B., and BARTRUM, J. A., 1929. Mollusca from Kaawa Creek Beds, West Coast, South of Waikato River, *Trans. N.Z. Inst.*, vol. 59, pp. 139-162.

—— 1930. The Tertiary (Waitematan) Molluscan Fauna of Oneroa, Waiheke Island, *Trans. N.Z. Inst.*, vol. 60, pp. 395-447.

SUTER, H., 1913. Manual of the New Zealand Mollusca, Government Printer, Wellington.

—— 1914. Revision of the Tertiary Mollusca of New Zealand, Pt. 1, *N.Z. Geol. Surv. Pal. Bull.* No. 2.

—— 1917. Descriptions of New Tertiary Mollusca occurring in New Zealand, *N.Z. Geol. Surv. Pal. Bull.* No. 5.