

New Zealand Foraminifera: Key Species in Stratigraphy, No. 4.

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As in the previous parts, "CCL" stands for *Contributions to the Cushman Laboratory for Foraminiferal Research*, localities mentioned more than once are referred to by numbers with explanatory list at end, only the largest dimension is given, and co-types have been forwarded to the Cushman Laboratory (Sharon, Mass.) and to the Parr collection (Melbourne).

CONOTROCHAMMINA n.gen. (Fam. Ammodiscidae).

Genotype: *C. whangaia* n.sp.

An arenaceous isomorph of *Fischerina*—a tubular cone divided into chamberlets, with constricted aperture in centre of terminal face. *Trochammina* applies to depressed *Discorbis*-like forms with aperture at base of last chamber; the present form is wound like *Turrispirillina* and bears somewhat the same relation to *Trochamminoides* as *Ammodiscoides* does to *Ammodiscus*.

Conotrochammina whangaia n.sp. (Plate 62, figs. 1, 2.)

Coarse sand grains in little cement, wound in compact rapidly descending spiral, about as high as wide; 2–3 coils, about 6 chambers in each, marked only by faint constrictions, all sutures very obscure, not interrupting outlines. Umbilicus deep, up to third of width. Aperture a tiny circular opening at centre of terminal face and only a fraction of its area. Size, 1mm. each way.

Type from 5374; index of Whangai. Not seen in Lower Rakauroa or type Piripauan, but present in the Waitangi *Rzehakina* Red Shales. The only specimens clearly showing chamber constrictions and aperture are from 4050, Waipawa Black Shale, where they are abundant but distorted.

Cyclammina grangei n.sp. (Plate 62, figs. 3, 4.)

Fine cement, no large grains, white, smoothly finished, shining; edge acutely angled. Outer half gently sloping to this edge, inner half suddenly swollen round distinct narrow umbilicus, giving a crater-like effect. 10–11 chambers, radial sutures grooved, sometimes faintly sigmoid; internal labyrinth apparently of simple type, showing through on surface as 5–6 equidistant dark lines projecting forwards from sutures about a third of way across chambers; the alternation of short white and dark lines very marked when surface is moistened, simulating retral processes of *Elphidium*. Apertural face with coarser grains, a little roughened, without opening at periphery. Size, 0.7 mm.

Type from 5338, Lower Bortonian. Common at this horizon in North Island, but present also in Upper Bortonian and Piripauan.

***Siphotextularia kreuzbergi* n.sp.** (Plate 62, figs. 5, 6.)

1930. *Bolivina hantkeniana*, Kreuzberg, *Neuen Jahrb. für Min., etc.*, Beil. Bd. 64, Abt. B, p. 278, pl. 20, fig. 6; non Brady.

Very fine sand-grains in much cement, smoothly finished, darker and coarser posteriorly. Much compressed, expanding rapidly from sharp apex at 90° for about one-third of shell, then sides sub-parallel. Greatest thickness (about one-third width) at half-way, bevelled in all directions to acute slightly thickened flange surrounding whole shell, a little wing-like anteriorly. About 7 pairs chambers with small spiroplectine apex, progressively less embracing, lower parts a little bulbous, sutures deep, 20–30° from horizontal. Aperture a little rounded tube springing from flange almost at base of chamber. Size, 0.75 mm.

Type from G.S. 1240, Upper Ihungia. Rather rare, seen mostly in Hutchinsonian; Kreuzberg's examples were from the (probably Lower) Ihungian of Whakatu Stream, left tributary of Waiapu River, Mangaoporo S.D. One occurrence known in the Tutamoe (Awamoan) of Pourerere S.D. (5845) with *Siphogenerina pohana*.

***Siphotextularia ihungia* n.sp.** (Plate 62, figs. 7, 8.)

Fairly fine sand-grains, not much cement, smoothly finished, darker and rougher posteriorly. Expanding from sharp apex regularly at about 70° and rapidly thickening to half of width (resembling *S. acutangula* Finlay; previous number, p. 310); sides sharply serrate for whole length. 9–10 pairs chambers, considerably embracing, all but last 2 about 4 times long as wide, fairly convex with deep sutures at slight angle from horizontal; last 2 much inflated at sides, flattish on top. Aperture an elongate spout, nearly halfway up face, with well-raised rim. Size, 0.9 mm.

Type from G.S. 1240, Upper Ihungia. Same rarity as the allied *kreuzbergi* but much thicker, not flanged anteriorly.

***Siphotextularia subcylindrica* n.sp.** (Plate 62, figs. 9, 10.)

Very small, rather fine sand-grains in much cement, brownish. Expanding very quickly from blunt rounded apex, then sides sub-parallel over three-fourths of shell; thickness almost similarly increasing to three-quarters of width; flattened down front, sides broadly rounded. First chambers obscure, about 6 pairs visible, flattish, with shallow sutures; last 2 subtriangular, flattened at about 45° on top. Aperture an elongate slit, about one-third length of terminal face and a quarter way up it, bordered by thin raised rim all round. Size, 0.55 mm.

Type from 5703, base of Upper "Blue Bottom," Callaghan's Creek, Waimea S.D., Westland; not uncommon in Tongaporutuan and Urenui beds. Index of Taranakian.

***Eggerella columna* n.sp.** (Plate 62, figs. 14, 15.)

Fine and coarse sand-grains in much cement, surface slightly roughened, almost perfectly cylindrical, polyserial apex very bluntly rounded, not marked off from remaining coils (about 3) of non-inflated triserial chambers; sutures hardly visible, spire outlines little interrupted; last 3 chambers sub-globular, much flattened on

top, sutures deepening towards depressed centre. Aperture a very tiny circular opening at centre. Size, 1 mm.

Type from 4012, bentonitic shale of Red Shale Stream, Waitangi Hill Road, with *Rzehakina*. Only known from this Uppermost Cretaceous horizon. No described species is at all as cylindrical.

***Eggerella ihungia* n.sp.** (Plate 62, figs. 11-13.)

Fine and coarse sand-grains in much cement, smoothly finished, brownish, not quite twice as long as wide, bluntly pointed; polyserial chambers obscure, rather more than a third of shell; about 2 coils of triserial chambers, little inflated, sutures shallow, indistinct anterior join of last 3 chambers flattened off at angle of 30°, central point hardly depressed, aperture an obscure narrow chink somewhat off centre. Size, 0.8 mm.

Type from 5390, Rotokautuku Creek. Also in 5242, Takapau S.D. and 5056 Terakohe Quarry, but otherwise rare. Index of true Hutchinsonian. Related to the Arctic *E. advena* (Cush.), which is longer and has much deeper sutures and far more chambers.

***Dorothia elongata* n.sp.** (Plate 62, figs. 16, 17.)

Finely arenaceous, much cement; irregular numerous grains so neatly fitted and flush with surface that almost invisible. Surface faintly shining, dull white, smooth. Initial triserial part a little swollen, very small, sutures indistinct; biserial part 5-6 times as long, a little twisted; chambers about 6 pairs, progressively more inflated and with deeper sutures (and thus more lobulate shell outline) a little flattened at about 30° anteriorly; median sutures not plain, weaker than sub-horizontal side ones. Aperture rounded, about half as high as slanting 45° terminal face. Shell in general about midway between *Gaudryina whangaia* Fin. (previous number, p. 311) (similarly white but larger, without initial sharp angles) and *Karrerrella cushmani* Finlay (see later) (darker, with pronounced polyserial part and spout aperture). Size, 1.2 mm.

Type from 5372, Weber bridge, 1 m. S.E. of Weber; Whāngai. Index of Piripauan; sometimes the only recognisable species in the poorly fossiliferous argillitic part; one of the best and most persistent key species of this age. It has not been seen in company with *Gaudryina whangaia*, and it is possible that the *Rzehakina* Piripauan strata are divisible into a lower horizon (with *D. elongata* and *Gaudryina healyi*) and an upper (with *G. whangaia* and *Conotrochammia whangaia*). With belemnites in 5311, base of Katiki Beach section, but not in Danian Moeraki beds above. Evidently a close relative of the European Cretaceous *pupoides* d'Orb., which has subglobular chambers and deep sutures.

Genus KARRERIELLA Cushman, 1933 (Fam. Valvulinidae).

Subgenus KARRERULINA n.subgen.

Genotype: *Gaudryina apicularis* Cush., 1911 (*U.S. Nat. Mus. Bull.*, 71, pt. 2, p. 69); new name for *siphonella* of Brady (*Chall. Zool.*, vol. 9, pl. 46, figs. 17-19.), non Reuss. Indo-Pacific and East Coast of U.S.A., in deep water.

This species has been discussed and fully figured by Cushman (*CCL Special Pub.*, No. 8, p. 110, pl. 12, figs. 22-26, 1937) and placed

in *Plectina* because of the terminal aperture. Two other species there discussed seem congeneric:—*Karreriella postsiphonella* (Span-
del) (*ibid.*, p. 127, pl. 15, fig. 9) and *Dorothia* (?) *conversa* Grzyb.,
as figured, in part at least, by Jedlitschka (*ibid.*, p. 79, pl. 13, figs.
1-4).

These all differ from *Karreriella* in having a quite terminal aperture formed by a constricted prolongation of last chamber (instead of a narrow-walled more or less compressed spout usually set in an excavated area near base of last chamber, which rises above it as in *Siphotextularia* Fin.). *Plectina* has a sunken aperture without spout.

***Karrerulina bortonica* n.sp.** (Plate 62, figs. 18-20.)

Closely related to *apicularis* but less than half size, with bluntly rounded base and obscure triserial chambers; about 4 times as long as wide, with 4-5 pairs biserial chambers (more than in Recent species, although smaller shell); of coarse material with indistinct sutures except on last half. Size, 0.8 mm.

Type from 5338, Lower Bortonian. Common here, less so in Upper Bortonian, and increasingly rare in Kaiatan, and perhaps later; not seen in Cretaceous.

In the Danian and Lower Bortonian is ***Karrerulina aegra* n.sp.** (plate 62, figs. 21, 22, 25, 26), somewhat smaller, more slender, 4-5 times as long as wide, with smaller and much less bulbous triserial part. Chambers obscure, sutures hardly affecting spire outline; of rather coarse grains smoothly set in much cement, surface slightly rough. Size, 0.6 mm. Type from 5746, upper Moeraki Beds below Hampden Bortonian (Wangaloan). A still earlier species is ***Karrerulina clarentia* n.sp.** (plate 62, figs. 23, 24), common in the Raukumara, smaller than the others and still more slender, 5-6 times as long as wide, 6-7 pairs vertically compressed biserial chambers with rather deep sutures interrupting spire outline all over; very small triserial part. Size, 0.6 mm. Type from 5375, Porangahau S.D., 1 m. at 165° from Trig D; Raukumara Beds. Other Cretaceous and Tertiary species are known.

***Karreriella novozealandica* Cushman.**

1936. *Ibid.* Cushman, *OCL Special Pub.*, No. 6, p. 37, pl. 5, figs. 18a, b.

1937. *Ibid.* Cushman, *OCL Special Pub.*, No. 8, p. 133, pl. 15, fig. 9.

This was described from "Miocene of Motutara," a very vague locality. Parr* (*Journ. Roy. Soc. W.A.*, vol. 24, p. 88, 1938) has stated that *Nomion novozealandicum* Cush. (which was similarly localised) was from the "Lower Oligocene of Motutara Point, Kawhia Harbour." In passing, it may be mentioned that this species is a synonym of *Nomion maoricum* (Stache), described (as *Rosalina*) from the type Whaingaroa beds (*Novara Pal.*, vol. 1, p. 282, pl. 24, fig. 32, 1864). The Motutara beds are of Whaingaroan age, now placed as Mid-Oligocene. *K. novozealandica* does not range above this (5047,

*In a recent letter Mr Parr informs me that Cushman's material labelled "Motutara" and "Kawhia" was purchased in France, and that similar material bought in Melbourne came originally from Tempere's French collection and contained all the characteristic Motutara species.

5577, etc), but is not uncommon in the Kaiatan (e.g., 5680) and continues back to Lower Bortonian; no true *Karreriella* is known from our Cretaceous. Bortonian examples (from 5382) are here figured (plate 63, figs. 35-37) to show the rather stout habit, somewhat compressed shell, about 8 biserial chambers, convex terminal face and short bulbous polyserial part.

In the Waitakian, Hutchinsonian and Awamoan, the common form is *Karreriella cushmani* n.sp. (plate 63, figs. 38-42), considerably more attenuate, still lightly compressed with deep sutures and lobulate outline, but about 12 pairs biserial chambers, more elongate and detached, a flattened end face, and longer less bulbous polyserial part. Size, 2.1 mm.; type from G.S. 1240, Upper Ihungia.

In the Taranakian is evolved a form, *Karreriella cylindrica* n.sp. (plate 63, figs. 43-46), which lasts till the Waitotaran (2102); large and elongate like *cushmani*, but much more compact, with little inflated chambers, shallow sutures, a cylindrical shape and hardly lobulate outline, polyserial part relatively much more pointed, not bulbous but spirally merging up into adult chambers. Size, 2.1 mm. (Pliocene examples smaller); type from 5557A, Tongaporutuan. This form has already been figured, under the name "*Karreriella siphonella* (Reuss.)," by Parr (*Trans. Roy. Soc. N.Z.*, vol. 65, pt. 2, p. 84, pl. 20, fig. 3, 1935), from the Taranakian of Medway River.

Nodosaria subtetragona n.sp. (Plate 63, fig. 47.)

Extremely close to *tetragona* Costa as figured by Cushman and Jarvis, 1930 (*Journ. Pal.*, vol. 4, no. 4, p. 360, pl. 33, fig. 1), but widening more rapidly and somewhat twisted. No complete adults yet found; proloculum sub-oval, bluntly pointed, next chamber shorter, narrower and squarish, rest oblong, becoming about twice as long as wide, a gradually broadening very thin flange running up each side, about equal to width between the two other ribs, which are much lower and run up centre of shell equidistant from themselves and flange, slightly lower at sutures; first 3 or 4 chambers with slight twist, rest of surface usually quite smooth; senile shells with a few extra riblets. Size, 2.2 mm.

Type from G.S. 1342, Tutamoe. Ranges from Upper Ihungia to Taranakian.

A related form from a higher horizon is *Nodosaria sinalata* n.sp. (plate 63, fig. 49). This is identical in the early stages, having same proloculum, early chambers and twist, but is more slender and chambers lengthen more rapidly to 5-6 times their width; chief difference is loss of side flanges and more numerous ribs; 8 equal slender ridges about 3-4 times width apart; size 2.2 mm. Type from 5561, Waitotaran. Ranges from here down to Tongaporutuan, where it accompanies *subtetragona*. The Pliocene Indo-Pacific *tosta* Schwager is closely related, but has only 6 costae (see Cushman, 1939, *Trans. Pal. Soc. Japan*, vol. 14, no. 14, p. 149, pl. 10, fig. 2).

A still more costate form is *Nodosaria* (?) *multicostales* n.sp. (plate 63, fig. 48) with flange each side and seven subequidistant ridges between, others intercalated later; differing from *subtetragona* also in much more arched sutures and much slighter twist; size,

1.5 mm. Type from 5207, Eketahuna mudstone; apparently restricted to Opoitian. This is transitional to *Rondicularia* and might be better referred there.

***Amphicoryne prora* n.sp.** (Plate 65, figs. 148, 149).

Differs at sight from the Recent *A. falx* (J. and P.) in absence of sculpture, subspherical last two chambers, more elongate and prow-shaped initial part with sharp keel curved almost at right angles to a point jutting beyond sides; 8 or more long narrow chambers in vaginuline part; aperture a thick tube, without rings. Size, 0.9 mm.

Type from 5273, Awamoan. Known from Whaingaroan (1279); rarity makes upper limit uncertain.

***Gumbelina panikauia* n.sp.** (Plate 63, figs. 53-55.)

Smooth, with few chambers, apex rather blunt, width and spherical chambers at first rapidly increasing then less so, sides of last 4 sub-parallel; last sometimes smaller, about 5 pairs with deep distinct sutures; aperture relatively small, without lip or ears joining previous chamber, surface quite smooth and shining. Size, 0.4 mm.

Type from 5698; Piripauan index. *G. globulosa* (Ehrenb.) is similarly smooth, but has much more acute apex with 6 chamber pairs, a large widely gaping aperture and little tendency to alter taper anteriorly. The European species is common in the West Australian Gingin Chalk and is readily separable from *panikauia* in aperture alone.

A species also with about 5 pairs of chambers is ***Gumbelina ototara* n.sp.** (plate 63, figs. 50-52), common in the Oligocene (type from 5182; Kaiatan. Size, 0.23 mm.); chiefly distinguished by minute size, smooth compact shell, and little separated chambers.

***Bolivinoidea dorreeni* n.sp.** (Plate 63, figs. 56-58.)

Sub-diamond shaped, increasing regularly in thickness to aperture end; apex a little swollen by rather large proloculum, sides angled with fairly sharp, slightly serrate edge, anteriorly flatly rounded; 8-9 pairs of chambers, sloping at 45°, narrow faintly curved sutures obscured by ornament, a medial almost grooved area formed by 2 ribs running up centre, slightly diverging and strongest basally. 4 narrow raised ridges prominently cross excavated spaces between thickened tops of chambers at right angles to sutures, approximately continuous. Aperture a short narrow slit at right angles to base of chamber. Size, 0.5 mm.

Type from 5698; Piripauan index. Related to *decorata* Jones and *delicatula* Cushman, but with much more distinct fenestrate sculpture, due to the stronger narrow ridges.

***Rectobolivina hangaroana* n.sp.** (Plate 63, figs. 59-61.)

Large, stout cylindrical, slightly compressed. Micro form tapering to blunt point; 8-9 biserial chambers then unknown number of uniserial. Megalo form hardly tapering, with swollen apex formed of large proloculum and 3 biserial chambers; after slight constriction 6 uniserial chambers follow; whole shell covered by very fine, dense ridges with linear interstices continuous across sutures and giving

appearance of fine striation; chambers gradually increasing in height, last one longer, constricted a little to rim round large oval aperture. Size, 1.1 mm. (megalo type); 0.88 mm. (micro paratype).

Type from 5018; index of Upper Poha (Urenuian?); also in 3114, Waimata S.D. Related to *columellaris* Brady, especially the variety *semistriata* Schubert, but more densely and completely striate, with fewer and less inflated chambers. The reference of such forms to *Siphogenerina* seems a mistake; there is nothing in common with *costata* Schlumb., but much with *bifrons* Brady.

Bulimina miolaevis n.sp. (Plate 64, figs. 70, 71.)

Miocene representative of the Eocene *bortonica* Finlay; similarly smooth all over, but much larger, with less inflated, more closely knit chambers; spire outlines less lobulate, almost straight; aperture shorter, not cutting across base to form notch on opposite side, a few faint indentations in horizontal suture at beginning of each chamber sometimes present. Size, 0.9 mm.

Type from 3013, Whangara, Middle Ihungia. Usually rare, but common in the true Hutchinsonian of Pourerere S.D. (5347, 5858). Index of Hutchinsonian. A Whaingaroan form (5681) is close.

Bulimina mapiria n.sp. (Plate 64, fig. 72.)

A nearly smooth form with strong apical spine, spire with marked twist, chambers rapidly descending, not numerous, somewhat elongate, the last narrowing to blunt angle anteriorly; sutures distinct but very shallow; early third of shell with numerous irregular costae merging posteriorly into strong sharp spine, rapidly dying anteriorly, last volution and most of previous one smooth. Size, 0.6 mm.

Type from 5018; common in the Mapiri and elsewhere at this Upper Poha horizon, together with *Bolivinita compressa* Finlay.

Bulimina rakauroana n.sp. (Plate 64, figs. 75, 76.)

An *aculeata*-like form of large size with apical spine, chambers lightly inflated, smooth except for a row of numerous short spines on shoulder just below suture, crossed by faint groove, producing a doubled effect, faint traces of costae on earlier chambers, horizontal sutures deeply cut, forming staged spire, aperture large. Size, 0.8 mm.

Type from 3270, Lower Rakauroa; index of Piripauan. Very close to *midwayensis* C. and P. (*CCL*, 12, 2, p. 42, pl. 7, figs. 9-10, 1936), which has inflated chambers and stronger spines further down on chambers, without groove. Even closer to the Californian Cretaceous *spinata* C. and C. (*L.c.*, 11, 3, p. 72, pl. 11, fig. 11), but relatively longer and less inflated.

Bulimina senta n.sp. (Plate 64, figs. 73, 74.)

A development of the *inflata* type, in which spire chambers are closely appressed and not much descending, costae greatly weakened but developing short, strong, downward pointing, blunt spines on shoulder of each chamber, the rather distant spikes jutting from points some two-thirds of chamber width from previous suture. Apex with a long, strong spine; last 3 chambers making up more than half shell, practically smooth, except for spines. Size, 0.7 mm.

Type from G.S. 1342, Waikura Stream, Tutamoe. Ranges from Hutchinsonian (5347) to Lower Taranakian (3151).

Bulimina truncanella n.sp. (Plate 64, figs. 89-91.)

Tiny, triangular, about twice as long as broad; sides sub-parallel, rapidly tapering near apex to sharp point, but no spine; apertural end obliquely truncate at about 40°, chambers indistinct, not inflated, overridden by heavy sculpture of sharp, linear ridges, about 18 in number, continuous from apex to just on to base of last chamber, sub-equidistant but arranged roughly in threes, a rather stronger triplet down each blunt angulation with 2 to 3 on sides between, last chamber mostly smooth. Size, 0.27 mm.

Type from 5540, Hampden section; Lower Bortonian. More or less common from here to Tongaporutuan (3137). Evidently related to *truncana* Gumbel (see CCL 13, 3, p. 66, pl. 9, fig. 3, 1937) but much smaller, less inflated and with far more costae.

A form extremely like *truncana* does, however, occur in the North Island Hutchinsonian-Awamoan, **Bulimina bremneri** n.sp. (plate 64, figs. 84-86), differing apparently only in slightly more trigonal section and more inflated chambers leading to distinct cut-in sutures, stepped appearance between ridges, and less pointed and tapered apex; twice size of *truncanella* (0.4 mm.) with about 12 heavy costae; type from 5033, Patutahi S.D. (1½ m. n. 75° W. from Trig XII), Upper Ihungia; also in Tutamoe.

Bulimina forticosta n.sp. (Plate 64, figs. 77-81.)

Like American Eocene *jacksonensis* Cush. (see *U.S.G.S. Prof. Paper 181*, p. 35, pl. 13, figs. 7-9, 1935), but less elongate, widening rapidly, slightly sub-triangular in section with 11-12 strong costae, instead of 6-8; number and style of ribs very like *truncana* Gumbel, but aperture and chamber formation of *jacksonensis* style. The Oligocene *sculptilis* Cushman, has 10 costae, but is elongate. Size, 0.7 mm.

Type from Waitangi No. 1 Well Core (Core 9, no. 3), 750 ft.; Upper Bortonian. Also present in Point Elizabeth beds (5359); Whaingaroan.

Bulimina pahiensis n.sp. (Plate 64, figs. 87, 88.)

Triangular in section; keels sharpening towards pointed but not spined apex, blunted anteriorly, where sides become sub-parallel; chambers indistinct, sutures almost flush, whole upper surface covered by fine vertical ridges, sharp but very close and barely visible, slightly twisting as they descend; an indentation in upper posterior suture of each chamber, last few chambers becoming smooth. Size, 0.6 mm.

Type from 3310, Pahi marl. Index of Upper Bortonian; related to the Midway *cacumenata* C. and P. (CCL, 12, 2, p. 40; pl. 7, fig. 3, 1936), but much larger, with sharper keels and finer striae. The Aragon *semicostata* Nuttall is as large, but has much coarser ornament.

An Upper Oligocene relative is **Bulimina scobinata** n.sp. (plate 64, figs. 82, 83), also sub-triangular, with rounded keels, distinct but shallow sutures, a twisted spire and sub-circular little inflated chambers, finely roughened or shagreened all over by minute pitting; size, 0.9 mm.; type from 5093 Porangahau S.D. (also 5275, Kawa-Kawa Trig, and 1005). This much resembles the Trinidad Eocene

jarvisi C. and P. (*l.c.*, 12, 2, p. 39, pl. 7, fig. 1, 1936), but has no fine costae. It also occurs in the Poverty Bay Maungatapere formation (Whaingaroan), at Waikura Stream (5365).

***Cassidulina cuneata* n.sp.** (Plate 63, figs. 62-66.)

Irregularly wedge-shaped, angled round aperture, bulbous posteriorly, 4 triangular chambers round a central square visible in front view, each suture bisecting next and running straight across surface; 4 also in back view, the upper (largest) triangular with a squarish sub-globular one below, with smaller ones each side. Aperture large and gaping, semicircular, the straight edge set at 45° to suture, with a strong, sharp, flat tooth projecting almost halfway across it from base. Size, 0.7 mm.

Type from 3137, Kaiti Beach, Poverty Bay, basal Taranakian. Enters commonly in Hutchinsonian and lasts to Urenuian; common throughout our Miocene, absent in Pliocene. Differs in sub-trigonal form from all our other species. Has been usually identified as *murrhyna* Schwager, but the original figure of that Indo-Pacific Pliocene species has no resemblance, especially in the aperture, which is chink-like, set in a produced beak-like last chamber, as in some forms of *subglobosa* (cf. the Antarctic *producta* Chapman and Parr, compared by the authors with *murrhyna*). Specimens from the basal Ouba formation (Upper Miocene), of New Guinea, in a fauna closely resembling that from Kar Nicobar are quite close to *subglobosa* and in no way resemble these N.Z. shells. But an Upper Mena fauna (Middle Miocene) from the same district contains a few specimens of an extremely similar species.

Except in the basal "Blue Bottom" of Westland (possibly still true Hutchinsonian) this form is uncommon in the South Island, where the apparently unsuitable facies makes its lower range limit uncertain. It has not occurred in the Waitakian of Cobden district, Mid-Waipara, or Weka Pass, but is present, with *Cibicides verrucosus* and *Margulinopsis* aff. *hochstetteri* in a Hawke's Bay formation (5854, Mangaotero S.D.) which seems to be of this age.

***Nonion iota* n.sp.** (Plate 65, figs. 108-110.)

Very similar to *N. micrum* Cole and *danvillense* Howe and Wallace (see Cushman, *U.S.G.S. Prof. Paper, No. 191*, p. 5, pl. 1, figs. 19-22, 1939); same small size and deep sutures as *danvillense*, but with the fewer chambers of *micrum*; more inflated chambers than either, leading to more lobulate periphery and more sunken umbilical area each side; shell usually more compressed with rounded periphery. Size, 0.25 mm.

Type from 5300, Upper Bortonian. Index of Lower Bortonian (5570) to Kaiatan.

***Nonionella magnalingua* n.sp.** (Plate 65, figs. 144, 146.)

Of the *turgida* (Will.) style, but inflated, not compressed; perhaps nearest *jacksonensis* Cush. (*U.S.G.S. Prof. Paper, 191*, p. 29, pl. 8, fig. 2, 1939), but stouter, less elongate, with rounded base, much less coiling visible. About 8-9 chambers in the single coil, which is initially swollen and marked off by deep sutures and almost an umbilicus; last chamber continued up on one side as a very large swollen

tongue completely hiding spire, base widely rounded, in front view widest medially, axis of last chamber intersecting vertical axis at 20° ; size, 0.4 mm.

Type from 5124, Awamoa Creek, type Awamoan. Seen also in Duntroonian (5699), fairly often in Taranakian, and finally in Waitotaran (5561). The Kai-Iwi and Recent form is distinct.

A longer ranging species is *Nonionella zenitens* n.sp. (plate 65, figs. 145, 152–156), of similar small size, general shape, and polished shining test, but with very feeble tongue, not reaching above margin of coil, which is but little immersed in it and is marked off by much feebler sutures, base sub-acutely rounded, sides much straighter; asymmetry obvious only in basal view. Recalls *N. extensa* Brotzen (Cushman, *l.c.*, p. 28, pl. 7, fig. 7), but larger, more inflated, with converging not sub-parallel sides in front view and less visible coiling; size, 0.4 mm. Type from 5179A, Hampden, Upper Bortonian; lasting to Middle Miocene (fig. 145), where it occurs together with *magnalingua*, but apparently not present in Taranakian; extends down to Lower Bortonian (5570).

Of the same size and chambering but with still weaker tongue and stout shell is an offshoot *Nonionella satiata* n.sp., apparently confined to Awamoan; much more inflated at upper three-quarters, base still being broadly triangular, the still weaker asymmetry set at an angle of 45° to vertical, acutely rounded below in both side and front views, side opposite aperture much more convex. Type from 5124, Awamoa Creek.

A Cretaceous development with tongue so reduced that symmetry is almost attained is *Nonionella tanumia* n.sp.; same size as *zenitens*, but early chambers curved well above aperture, which is conspicuously open and narrowly rounded like *Chilostomella*, base only about three-quarters length of shell instead of as long and bluntly instead of acutely rounded in both side and front views, basal sides more nearly parallel, extending only very slightly higher on one side. Type from 5860 (Tanumi Bridge, just overlying Waipawa black shale); confined to Piripauan.

***Elphidium hampdenensis* Finlay.**

1939. *Ibid.*, *Trans. Roy. Soc. N.Z.*, vol. 69, pt. 1, p. 127, pl. 12, figs. 29, 30.

Figures, type locality, and range of this species have been given, but no diagnosis. It is fairly compressed, flattened and faintly excavate medially, with angled but not acute keel marked by a cord, one coil visible, with about 10 obscurely marked chambers, radial sutures ridge-like, strongly curved, 2–3 times width apart; spaces between with spiral ridges of about similar strength, about 7 per chamber; umbilical area tiny, with no ornament but the ridges; apertural face an isosceles triangle with slightly curved sides and openings at grooves along base. Size, 0.6 mm. Type from 5540, Hampden section; index of Lower Bortonian.

***Elphidium saginatum* Finlay.**

1939. *Ibid.*, *Trans. Roy. Soc. N.Z.*, vol. 69, pt. 1, p. 127, pl. 12, figs. 31–33.

Very inflated, flat medially, with flatly rounded periphery; one coil visible with 8 chambers, radial sutures almost straight, weak,

marked mostly by retral processes; a few shallow grooves a short distance after each suture, central area a small depression with encircling blunt ridge surrounded by a circle of shallow coarse pits, one after each suture; apertural face sub-crescentic, with openings along base. Size, 0.5 mm. Type from 5459, Mangaotero S.D., 178 ch. at 74° from Trig U; index of Upper Bortonian, but not present at Hampden. Common in Hawke's Bay and Poverty Bay, associated with *Zeauvigerina zelandica* and other Upper Bortonian forms.

Genus ANOMALINA d'Orb., 1826.

The first two species described below belong to the coarsely perforate group of "*grosserugosa* Gumbel," *rubiginosa* Cush., *dorri* Cole, etc., but the others have a superficially different appearance. The aperture and shell development, however, seem essentially the same, and no constant point has been observed to allow of even subgeneric separation. Some of the species resemble such gyroidine types as *Rotaliatina*, but are distinctly perforate, while *Gyroidina* and its allies have such minute pores that the surface appears quite smooth; the anomaline aperture is also more widely open, with usually a better developed lip and nearly always extends well over on to the dorsal side and back along the spiral suture. If the *dorri* group were split off on the basis of pore size, *Cibicides* would also need division on this count, and the utility of this is doubtful.

Anomalina visenda n.sp. (Plate 65, figs. 116-119.)

Shell large, inflated, dorsally 2 coils visible, ventrally involute with deep umbilicus; 8 chambers in last coil, swollen with distinct but not deep sutures, periphery flatly rounded; heavily ornamented above and below by intersecting diagonal ridges, producing pitted surface, like very coarse *Globigerina*. Centrally this ornament coalesces into regular, raised smooth patches dorsally and heavy rugae ventrally; anteriorly ornament weakens, last chamber with smaller pits and punctae. Periphery slightly smoother, terminal face quite smooth, aperture normal. Size 1.1 mm.

Type from 5371, type Wanstead, Upper Bortonian. Also in Lower Bortonian (5570); not seen below or above this. Related to the Mexican Lower Eocene *aragonensis* Nuttall, which has much coarser and more distinct pitting, especially ventrally.

Another species of this line is **Anomalina aotea** n.sp. (plate 65, figs. 111-115), which is smaller with rather fine pitting dorsally and smooth shining ventral surface, without medial coalescence or rugae. Last chamber practically smooth all over, 6-7 in last coil. Size, 0.5 mm. Type from 5179B, Hampden, Upper Bortonian. This has a much longer range, extending also into Piripauan and throughout lower Tertiary. Large specimens, perhaps a little more lobulate, occur commonly in the Weber (5835), Oxford Chalk (5047), and other Whaingaroan strata, but are not easily separable even from Piripauan forms (5301, 3270). This may be the upper limit of *aotea*.

Anomalina vitrinoda n.sp. (Plate 65, figs. 120-122.)

Compressed, periphery acutely rounded, flattish above and below. Ventrally involute, smooth and shining, sutures strongly curved at

outer two-thirds, then flush; dorsally with $1\frac{1}{2}$ visible coils, 13 chambers in last, sutures lightly curved, heavily limbate, spaces between and central knob coarsely punctate. Umbilicus filled by glossy knob above and below. Aperture like *Cibicides*, narrowly rounded on periphery, sharply limited ventrally, continued back along dorsal suture with thin lip, remnants from previous chambers projecting as little ears over suture. Size, 0.6 mm.

Type from 5089, Eason's Hill "Blue Bottom," Westland; true Hutchinsonian. Common from here to Tongaporutuan (often seen in Taranaki beds). Ranges down to Whaingaroan (1279, 1281, Waitetuna Estuary); examples from here may be Stache's *Rosalina orbiculus* (*Novara Pal.*, vol. 1, p. 285; Pl. 24, f. 34; 1864), but it will be better to use a definite name until his types can be re-examined, since his figure resembles several species.

A distinct relative in Bortonian, *Anomalina semiteres* n.sp. (plate 65, figs. 123-127), is less compressed, planoconvex, the almost flat base similarly smooth and shining, dorsal punctation finer and denser, radial sutures increasingly limbate near inner margin of coil and projecting as blunt points into groove between coils (which are more visible ventrally), dorsal knob somewhat broken into pustules, about 11 chambers per coil; size, 0.5 mm. Type from 5179B, Hampden, Upper Bortonian; not in Lower Bortonian; ranging into Kaiatan (5601, etc.), but no higher.

Anomalina miosuturalis n.sp. (Plate 65, figs. 128-131.)

Very compressed, periphery bluntly narrowly angled, bevelled each side, a little flatter on top than below. Ventrally involute, with moderate umbilicus; dorsally with $1\frac{1}{2}$ visible narrow coils, 15-16 chambers in last, sutures strongly curved, slightly and evenly limbate. Surface finely and densely punctate. Aperture with lip running from umbilicus, especially prominent round periphery and back along spiral suture for up to half a coil. Size, 0.5 mm.

Type from 5707, upper part of Middle "Blue Bottom," Eight-mile Creek, Hohonu S.D., Westland. Common in Miocene; entering in Duntroonian (5660) and ending in Awamoan.

A close relative common in the Eocene is *Anomalina eosuturalis* n.sp. (plate 65, figs. 132-137), differing only in indistinct radial sutures (broadening and poorly marked), fewer chambers (about 13), less curved sutures and obscure central portion, much more encroached on by last coil and lip. Size, 0.6 mm. Type from 5068A, Burnside marl; Tahuian. Ranges from Lower Bortonian (5540) to Whaingaroan (1279, 5047).

Anomalina subnonionoides n.sp. (Plate 66, figs. 172-180.)

Inflated, almost symmetrical, periphery very broadly rounded. Dorsally and ventrally involute with fairly wide, deep umbilicus filled by thickening of spiral suture as in some *Nonion* species; 1 visible coil, 10-11 chambers, densely punctate, aperture wide with prominent lip continued into ventral umbilicus and prominently running back for some 3-4 chambers along dorsal spiral suture; end face almost bisected by earlier periphery, but a little deeper and more convex ventrally. Size, 0.6 mm.

Type from 5273, Awamoan; common in Miocene. Connects up this group with the symmetrical *Nonion* at one extreme, while the compressed very asymmetrical species almost connect with *Cibicides* at the other. It would be a very slight step to develop this form from such a *Nonion* as *soldani* d'Orb. or *halkyardi* Cush. Related to the Recent Australian *nonionoides* Parr (*P.R.S. Vict.*, vol. 42, pt. 1, N.S., p. 231, pl. 22, fig. 38, 1929), but thicker, less coarsely perforate, and without the lobulate periphery. Ranges from Duntroonian (Chatton) to Awamoan.

***Anomalina spherica* n.sp.** (Plate 66, figs. 166-171.)

Very globose, simulating *Rotaliatina*, periphery broadly rounded, gently curved above, very convex below. Ventrally involute, very deep, narrow umbilicus with flatly rounded margin; dorsally with about 3 visible coils, 7-8 chambers in last, sutures fairly straight, not limbate; surface finely and densely punctate. Aperture narrow, long, with prominent lip merging into umbilical margin below, usually not reaching spiral suture above, but sometimes running back along it a little. Size, 0.5 mm.

Type from N. of Hen and Chickens in 30 f. Not uncommon during Pliocene (e.g., 4317 basal Opoitian), rare in Taranakian (5703, 5645), not seen earlier. Has only superficial resemblance to *Rotaliatina*, the texture, type of aperture and terminal face all disagreeing with *sulcigera* and like the other *Anomalinas* here described.

***Anomalina pinguiglabra* n.sp.** (Plate 66, figs. 160-165.)

Fairly inflated, periphery very convex, flattish on top, convex below. Ventrally involute with narrow, deep umbilicus; dorsally with large proloculum and nearly 2 visible coils, 9 chambers in last, sutures lightly curved, not limbate; surface finely punctate. Aperture wide, margined by prominent lip continued into umbilicus and back along spiral suture for 1 chamber. Size, 0.6 mm.

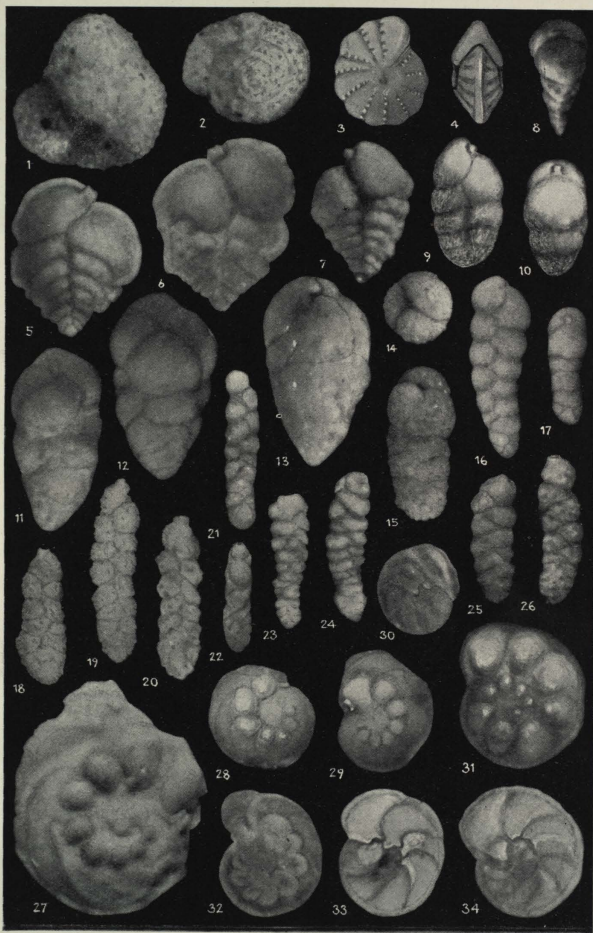
Type from 5273, Awamoan. Stands halfway between *macraglabra* and *spherica*. Ranges from Duntroonian (Wharekuri) to Awamoan.

***Anomalina macraglabra* n.sp.** (Plate 66, figs. 141-143.)

Moderately compressed, periphery bluntly angled, flatly convex on top, flatly convex below. Ventrally involute, with narrow not deep umbilicus; dorsally with 3 visible coils, 10-11 chambers in last, sutures strongly curved, not limbate, surface finely punctate. Aperture narrow, with marginal lip running into umbilicus and round periphery, but not back along spiral suture. Size, 0.57 mm.

Type from 5273, Awamoan; common in Hutchinsonian-Awamoan. Has been referred to as *glabrata* Cush., but topotypes of that Recent Samoan species, though with same chambering, are dorsally depressed, with wide umbilicus mostly plugged, coarser punctae, and a lobulate periphery. Begins in Duntroonian (5660) and lasts in abundance to Awamoan.

Of same style is ***Anomalina eoglabra* n.sp.** (plate 65, figs. 138-140) from the early Tertiary; general proportions and coiling same but smaller, with 13-15 chambers in last coil, dorsal sutures



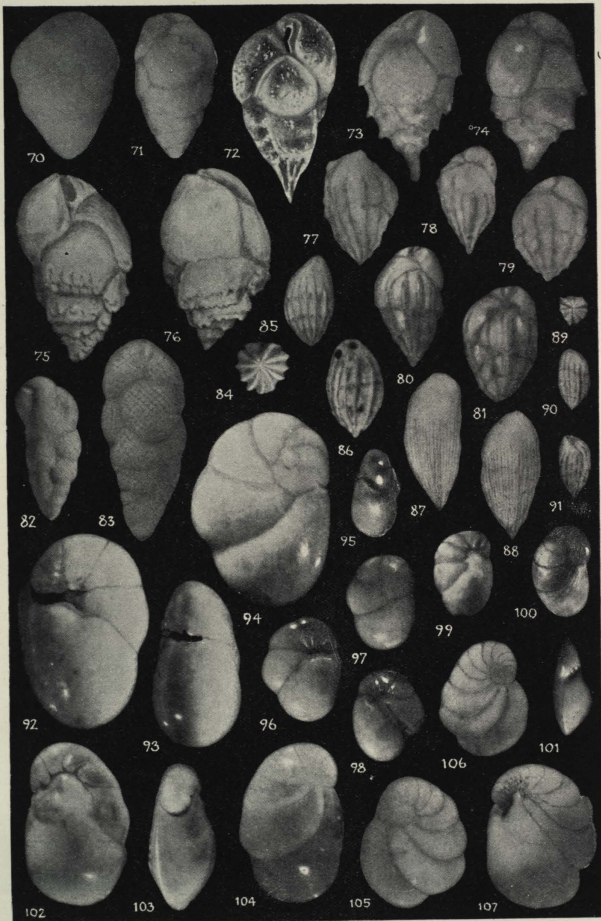
FIGS. 1, 2—*Conotrochammina whangaia* n.gen. n.sp. (1, type). $\times 30$. FIGS. 3, 4—*Cyclammina grangei* n.sp. (3, type). $\times 30$. FIGS. 5, 6—*Siphotextularia kreuzbergi* n.sp. (5, type). $\times 45$. FIGS. 7, 8—*Siphotextularia ihungia* n.sp. (7, type). $\times 30$. FIGS. 9, 10—*Siphotextularia subcylindrica* n.sp. (9, type). $\times 45$. FIGS. 11–13—*Eggerella ihungia* n.sp. (12, type; others from 5056). $\times 45$. FIGS. 14, 15—*Eggerella columna* n.sp. (15, type). $\times 30$. FIGS. 16, 17—*Dorothis elongata* n.sp. (16, type). $\times 30$. FIGS. 18–20—*Karrerulina bortonica* n.subgen. n.sp. (19, type). $\times 45$. FIGS. 21, 22, 25, 26—*Karrerulina aegra* n.subgen. n.sp. (26, type; 21, 22 from 5540). $\times 45$. FIGS. 23, 24—*Karrerulina clarentia* n.subgen. n.sp. (24, type). $\times 45$. FIGS. 27–29—*Laticarinina halophora* (Stache). (27 from 1279; 28, 29 from 5047). $\times 30$. FIGS. 30–34—*Parvicarinina altocamerata* (H.-A. and E.) (31, 33, 34 from 5099, normal; 30, 32 from 3029, wide flange). $\times 30$.

To face page 460.



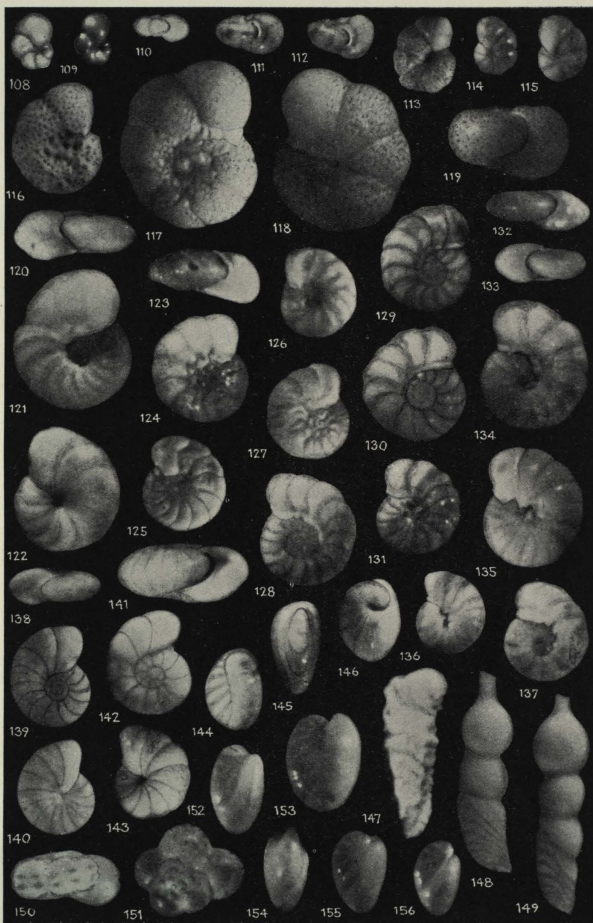
FIGS. 35-37—*Karrieriella novozealandica* Cushman (5382, Upper Bartonian). $\times 30$.
 FIGS. 38-42—*Karrieriella cushmani* n.sp. (38, 39, 42 from G.S. 1240, Upper Ihungia;
 40 from G.S. 1342, Tutamoe; 41 from 5105, Hutchinsonian; 39, type). $\times 30$.
 FIGS. 43-46—*Karrieriella cylindrica* n.sp. (43, 44 from 5557A, Cheviot "grey marl";
 Taranakian; 45, 46 from 5207, Opoitian; 44, type). $\times 30$. FIG. 47—*Nodosaria*
subtetragona n.sp. (type). $\times 30$. FIG. 48—*Nodosaria* (?) *multicostales* n.sp. (type).
 $\times 30$. FIG. 49—*Nodosaria sinolata* n.sp. (type). $\times 30$. FIGS. 50-52—*Gumbelina*
ototara n.sp. (52, type). $\times 45$. FIGS. 53-55—*Gumbelina panikauia* n.sp. (53, type).
 $\times 45$. FIGS. 56-58—*Bolivinoidea dorreani* n.sp. (57, type). $\times 45$. FIGS. 59-61—
Rectohelicina hangarona n.sp. (59, type). $\times 60$. FIGS. 62-66—*Cassidulina cuneata*
 n.sp. (62, 66 from 3137, $\times 45$; 63-65 from 5273, All Day Bay, $\times 30$; 66, type).
 FIGS. 67-69—*Nuttallides tholus* n.sp. (67, type). $\times 30$.





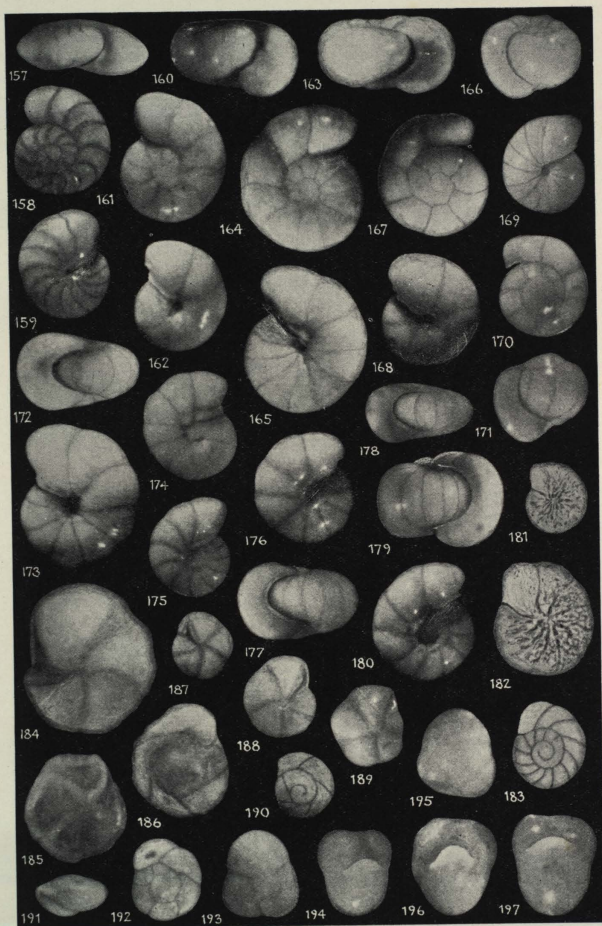
FIGS. 70, 71—*Bulimina miolaevis* n.sp. (70 from 3312, $\times 45$; 71, type, $\times 30$).
 FIG. 72—*Bulimina mapiria* n.sp. (type). $\times 60$. FIGS. 73, 74—*Bulimina senta* n.sp.
 (73, type). $\times 45$. FIGS. 75, 76—*Bulimina rakaurouana* n.sp. (75, type). $\times 45$.
 FIGS. 77-81—*Bulimina forticosta* n.sp. (77-79 from 5359; 80, 81 from Waitangi No. 1
 Well Core; 81, type). $\times 30$. FIGS. 82, 83—*Bulimina scobinata* n.sp. (82, type, $\times 30$;
 83 from 1005, $\times 45$). FIGS. 84-86—*Bulimina brenneri* n.sp. (86, type). $\times 45$.
 FIGS. 87, 88—*Bulimina pahiensis* n.sp. (87, type). $\times 45$. FIGS. 89-91—*Bulimina*
truncanella n.sp. (91, type). $\times 45$. FIGS. 92-94—*Cancris amplius* n.sp. (92, type).
 $\times 45$. FIGS. 95-98—*Cancris breviar* n.sp. (96, type). $\times 30$. FIGS. 99-101—*Cancris*
compressus n.sp. (99, type). $\times 30$. FIGS. 102-104—*Cancris mauricus* n.sp. (102,
 type). $\times 30$. FIGS. 105-107—*Cancris lateralis* n.sp. (107, type). $\times 45$.





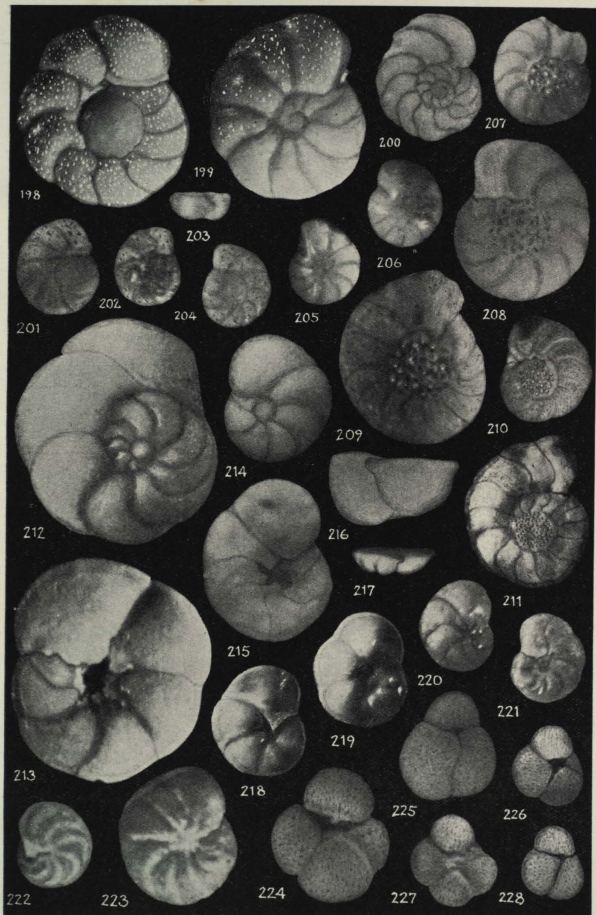
Figs. 108-110—*Nonion iota* n.sp. (109, type). $\times 45$. Figs. 111-115—*Anomalina aotea* n.sp. (112, type). $\times 30$. Figs. 116-119—*Anomalina visenda* n.sp. (117, type). $\times 30$. Figs. 120-122—*Anomalina vitrinoda* n.sp. (120, type). $\times 45$. Figs. 123-127—*Anomalina semiteres* n.sp. (123, 124 from 5179B, $\times 45$; 125 from 5001, $\times 30$; 126, 127 from 3286, $\times 30$; 124, type). Figs. 128-131—*Anomalina miosuturalis* n.sp. (128, type). $\times 45$. Figs. 132-137—*Anomalina eosuturalis* n.sp. (132, 133, 136, 137 from 5300; 134, 135 from 5068A; 134 type). $\times 45$. Figs. 138-140—*Anomalina coglabra* n.sp. (139, type). $\times 45$. Figs. 141-143—*Anomalina macraglabra* n.sp. (142, type). $\times 45$. Figs. 144, 146—*Nonionella magnalingua* n.sp. (146, type). $\times 45$. Fig. 147—*Gaudryina minuscula* n.sp. (5182, Cormack's, Oamaru, Kaikatoan). $\times 45$. Figs. 148-149—*Amphicoryne prora* n.sp. (5273, All Day Bay; Awamoan). $\times 45$. Figs. 150, 151—*Globigerina circumnodifer* n.sp. (151, type). $\times 45$. Figs. 145, 152-156—*Nonionella scitens* n.sp. (152-156 from 5179A; 145 from 5273; 155, type). $\times 45$.





FIGS. 157-159—*Anomalina parvumbilata* n.sp. (158, type). $\times 45$. FIGS. 160-165—*Anomalina pinguilabra* n.sp. (160-162 from 5132; 163-165 from 5273; 164, type). $\times 45$. FIGS. 166-171—*Anomalina spherica* n.sp. (166, 169 from 30f. N. of Hen and Chickens; 167, 168, 170, 171 from G.S. 1155). $\times 45$. FIGS. 172-180—*Anomalina subnonionoides* n.sp. (172, 173 from 5273; 174, 175, 177, 178 from G.S. 475; 176, 179, 180 from 5132; 173, type). $\times 45$. FIGS. 181-183—*Gyroidina infratossa* n.sp. (182, type). $\times 30$. FIGS. 184-186—*Pulvinulinella acutimarginata* n.sp. (184, type). $\times 45$. FIGS. 187-192—*Pulvinulinella creta* n.sp. (187, 190 from 5374; 188, 189, 191, 192 from 3250A; 189, type). $\times 45$. FIGS. 193-197—*Allomorphina whangai* n.sp. (193, 194 from 5698; 195-197 from 3249; 194, type). $\times 45$.





FIGS. 198-199—*Cibicides mediocris* n.sp. (198, type). $\times 45$. FIG. 200—*Cibicides catillus* n.sp. (type). $\times 30$. FIGS. 201-206—*Cibicides ihungia* n.sp. (201, 202, 205 from 3029; 203, 204, 206 from 4270; 202, type). $\times 30$. FIGS. 207-209—*Cibicides verrucosus* n.sp. (209, type). $\times 30$. FIGS. 210, 211—*Cibicides amoenus* n.sp. (210 from 5276; 211, type). $\times 45$. FIGS. 212, 213—*Discorbis scopos* n.sp. (212, type). $\times 45$. FIGS. 214-216—*Discorbis turgidus* n.sp. (216, type). $\times 45$. FIGS. 217-221—*Discorbis appositus* n.sp. (219, type). $\times 30$. FIGS. 222, 223—*Discorbis jugosus* n.sp. (223, type). $\times 30$. FIGS. 224-228—*Sphaeroidinella disjuncta* n.sp. (224, 225 from G.S. 1342, $\times 45$; 226-228 from 4270, $\times 30$; 226, type).



less curved, umbilicus a little narrower and shallower; size, 0.45 mm. Type from 5601, Kaiata mudstone; also in Piripauan (3250A), Bortonian (5540), and Whaingaroan (5047).

Anomalina parvumbilia n.sp. (Plate 66, figs. 157-159.)

Compressed, periphery bluntly angled, bevelled each side, subequally convex above and below, ventrally involute with tiny umbilicus, dorsally with proloculum and 2 visible coils, narrower than in other species, not rapidly enlarging; about 12 chambers in last, sutures strongly curved, limbate, especially nearing spiral suture and umbilicus. Surface finely and densely punctate. Aperture with prominent lip running from umbilicus, curving round periphery and ending just above it, not running back along dorsal suture. Size, 0.5 mm.

Type from 5132, Clifden, upper Hutchinsonian. Common in Miocene. Not seen below true Hutchinsonian, though a related form occurs rarely down to Bortonian (5300) and even Piripauan (3250A); ranges up at least to Nukumaruan (5395).

Of the *Anomalinas* here described, those characteristic of the Pliocene are *spherica* and *parvumbilia* (both abundant); the only ones observed in the Taranakian are *parvumbilia* (common in upper part), *vitrinoda* (common in lower part, ? absent in upper), and occasionally *spherica*; while *miosuturalis*, *subnonionoides*, *pinguiglabra* and *macraglabra* do not seem to outlast the Awamoan.

Several of these species have been confused in the past with the European *rotula* d'Orb, but there are many distinct forms of this general type.

GENUS *ROTALIA* Lamk., 1804.

In discussing this genus (*Trans. Roy. Soc. N.Z.*, vol. 68, pt. 4, p. 524, 1939) I considered *beccarii* and its allies *schroeteriana*, *conoides*, etc., as typical. But Mr. Parr has pointed out to me that *trochidiformis* Lk., the genotype, has a secondary series of chambers on the under side and that *Streblus* Fischer, 1817, should be used for the common Recent group. The type is *S. tortuosus* Fischer, a form of *beccarii*. Specimens of this Mediterranean species and the good figures of all growth stages given by Cushman (*CCL*, 4, 4, p. 104, pl. 15, 1928) differ from New Zealand specimens in being larger, flatter, and more ornate, the sutures heavily limbate and developing nodules when adult, the base very pustulose. True *beccarii* does not occur here, and the New Zealand form may be named:—

Streblus aoteanus n.sp.

Similar in general details to *Rosalina parkinsoniana* d'Orb., described from shore sands of Cuba, and figured from the Pleistocene of Maryland by Cushman (*CCL*, 6, 4, p. 100, pl. 13, fig. 14, 1930), but with much smaller umbilicus and plug, with narrower surrounding and sutural channels, the basal chambers much narrower, elongate, and more pointed. The total width of umbilicus is less than one-sixth of shell diameter, while in the West Indian form it is more than a quarter. Dorsally smooth, somewhat convex; 11 chambers per coil. Size, 0.55 mm.

Type from 5091, subfossil, Dunedin Harbour, dredged mud. Fossil throughout the Pliocene, but not common; probably absent below this.

A congeneric South Australian form has been figured from Hardwicke Bay shore sand as *Rotalia perlucida* H.-A. and E. by Parr (*Proc. Roy. Soc. Vict.*, vol. 42, pt. 1, N.S., p. 231, pl. 22, fig. 35, 1929). This has only 17 chambers per coil and is not at all like Heron-Allan and Earland's original figure which Cushman (*U.S. Nat. Mus. Bull.*, 104, pt. 8, p. 63, pl. 13, fig. 4, 1931) stated did not seem to represent a *Rotalia*. This Australian form is more like *tepida* Cush., but would be better described as new, as would also the Upper Pliocene Abbatoirs Bore form which Howchin and Parr (*Trans. Roy. Soc. of S.A.*, vol. 62, pt. 2, p. 303, 1938) recorded as *beccarii*; it has an enormous plug joined to the chamber ends and no surrounding channel at any stage. Forms quite close to *aoteanus* do, however, seem to occur in Tasmania and N.S.W. from the few specimens seen.

Mr Parr will be dealing with some of these Australian forms later; in a recent letter he has pointed out that the investigation of *R. trochidiformis* and the rejection of *Rotalia* for the *beccarii* group must be credited to Davies (*Trans. Roy. Soc. Edinburgh*, vol. 57, pt. 2, no. 13, pp. 401-428, Pls. 1-4, 1932), but that the selection of *Streblus* as the most suitable name for the latter is due to Dr Macfadyen.

Gyroidina infrafossa n.sp. (Plate 66, figs. 181-183.)

Planoconvex, periphery angled but not sharp, gently rounded above, about 3 coils, 10 chambers in last, sutures almost straight, sloping back at 45°, flush, hidden by layer of translucent material becoming progressively thicker on early chambers; base overridden by heavy sculpture mostly obscuring sutures, numerous irregular pitted ridges and anastomosing rugae radiating from umbilicus, abruptly ceasing just before periphery; aperture a narrow slit running from umbilicus up to but not over periphery. Size, 0.77 mm.

Type from 5374; index of Piripauan. Not yet seen in South Island type Piripauan, but present throughout North Island Tapu-waeroa and Whangai. Probably related to the Velasco *Rotalia beccarii-formis* var. of White (*Journ. Pal.*, vol. 2, no. 4, p. 287, pl. 39, fig. 4, 1928), but with still heavier ornament.

Nuttallides tholus n.sp. (Plate 63, figs. 67-69.)

The representative in our Cretaceous of *N. micheliniana* (d'Orb.), but dome-shaped with faintly concave top instead of conical; 6-8 chambers per coil, basal sutures not sigmoid, umbilicus small and shallow, dorsal coils very narrow with very slanting radial sutures, periphery a thin jagged edge turned up as a tiny flange, aperture mostly along ventral contact of last chamber, but upper end turning outwards as in *Pulvinulinella*. Size, 0.7 mm.

Type from 3242, Mata S.D., basal Rakauroa conglomerate; index of lower Rakauroa (Piripauan).

Pulvinulinella acutimarginata n.sp. (Plate 66, figs. 184-186.)

Differs from *tenuimarginata* C., P., and C. (*Journ. Linn. Soc. Zool.*, vol. 38, p. 565, pl. 9, fig. 19, 1934) mainly in having a still

more acute periphery marked by a narrow thin flange instead of a more or less sharp angle; shell larger, compression slightly greater, and ventral meeting of chambers not depressed. Size, 0.65 mm.

Type from 5664, Saurian beds, Mid-Waipara Section; type Piripauan. Index of this and Whangai. *P. tenuimarginata* enters in Lower Bortonian (5540), and is more or less common to end of Miocene; last seen in Lower Opoitian (G.S. 1155, Hicks' Bay).

Another Cretaceous species is *Pulvinulinella creta* n.sp. (plate 66, figs. 187–192), with sub-angled periphery; a small less compressed shell, flattish on top, somewhat conic below, dorsally with about 3 visible coils, about 5 chambers in each, slightly bulging at margin to give a pentagonal outline (the other two species are circular); aperture more open, with blunt lips. Size, 0.35 mm. Type from 3250A, Whangai. Also in 5664 and Lower Rakauoa. Index of Piripauan.

***Cancris amplus* n.sp.** (Plate 64, figs. 92-94.)

Large, smooth, shining, finely perforate, very inflated, chambers progressively more swollen, 6 in last coil above and below, flat above, flatly sloping below, periphery broadly rounded, sutures slightly limbate, later a little depressed, almost straight, deeply sunken on meeting umbilicus, round which blunt points of chambers protrude; last chamber balloon-like without keel; aperture reaching from periphery to penultimate chamber, almost hidden by lip, translucent patch large, circular. Size, 0.85 mm.

Type from 5273, Awamoan; index of true Hutchinsonian to Awamoan when common, but lasts to Opoitian (2057).

***Cancris brevior* n.sp.** (Plate 64, figs. 95-98.)

Like *amplus* but relatively shorter, wider and more compressed; 5 chambers in last coil, more rapidly uncoiling and with last much less inflated; periphery on aperture side bluntly sub-angled, elsewhere rounded; points of chambers entering umbilicus forming pronounced ridges; aperture shorter, more widely open; translucent area still larger, more lateral. Size, 0.6 mm.

Type from 5630, Lower beds, Pakaurangi Point. Index of true Hutchinsonian.

***Cancris lateralis* n.sp.** (Plate 64, figs. 105-107.)

Somewhat like *brevior* in shortness and width but with strong tendency to still greater lateral expansion; considerably smaller and still more compressed; periphery everywhere bluntly angular; dorsal chambers much more elongate and narrow, crescent shaped instead of sub-triangular, 9 in last coil. Ventrally 6 chambers visible, others obscured by heavy rugae overriding sutures. Aperture narrow, almost hidden by sinuous lip. Translucent area oblong, oval. Size, 0.6 mm.

Type from 5127, Ardgowan shell pit, Oamaru, Awamoan. Index of Duntroonian (Chatton) to Awamoan age.

***Cancris compressus* n.sp.** (Plate 64, figs. 99-101.)

Same elongate shape as *amplus* but much compressed, periphery angular all round, margin of last chamber especially sharp; 7

chambers in last coil, dorsal sutures broadly curved, ventral ones deepening progressively posteriorly but not forming rugae or projecting points, umbilicus being covered by apertural pad-like lip. Size, 0.55 mm.

Type from 5179A, Hampden, Upper Bortonian. Index of Upper Bortonian to Whaingaroan (1281, 5231), but always rare. Of all the forms here described this is nearest to *brongniarti* (d'Orb.), figured by Cushman, 1935 (*U.S.G.S. Prof. Paper, No. 181*, pl. 20, fig. 1) as similarly rare in the Jackson Eocene; but the N.Z. shell unwinds more rapidly and has much more curved dorsal sutures.

***Canceris maoricus* n.sp.** (Plate 64, figs. 102-104.)

Combines some features of *amplus* and *compressus*; relatively more elongate and much larger than either, considerably inflated and with same rounded periphery as in *amplus* till last chamber, which has sharp edge of *compressus*; dorsal surface markedly convex (flat-tish in *amplus*), 7 chambers in last coil, intermediate in shape between *amplus* and *compressus*. Aperture much as in *amplus* with similar open umbilicus and deep grooves. Translucent area roughly semicircular, broader than long, a large tongue-like pad extending from this area over umbilicus (hardly present in *amplus*, smaller but more obscuring in *compressus*). Size, 1 mm.

Type from 42 fathoms off Chicken Island, Hauraki Gulf. Common, not known from Tertiary. The European *auriculus* F. and M. is smaller and angled all round.

***Cibicides mediocris* n.sp.** (Plate 67, figs. 198, 199.)

Compressed, planoconvex, edge fairly sharp. Dorsally flat or faintly convex, only one coil distinctly visible, central part obscure and a little raised, with 9-10 chambers, sutures at right angles to spiral suture and flush at first, then strongly curved and depressed on last 3-4 chambers, not limbate, surface regularly, densely and somewhat coarsely punctate; ventrally lightly convex, medially flattened, sutures curved into weak umbilicus. Smooth and shining, with fine dense punctae; aperture normal, continued back dorsally for about 3 chambers. Size, 0.8 mm.

Type from 5273, Awamoan. Common in middle and lower Miocene, beginning in Waitakian. *Cibicides perforatus* (Karrer) (*Novara Pal.*, vol. 1, p. 81, pl. 16, fig. 13, 1864) from the true Hutchinsonian of Orakei Bay is much thicker, bluntly conical below with a large plug-like boss covering up to half of ventral surface, with very obscure and mottled dorsal surface, spiral and radial sutures indistinct after a third of coil from aperture, about 12 obscure chambers little curved above or below. Topotypes have a bluntly angled edge, but this is due to wear; good specimens from other localities of Waitematan age show no perceptible distinction from the later described *Cibicides maculatus* (Stache) (*ibid.*, p. 278, pl. 24, fig. 28), from the Mid-Oligocene Whaingaroa beds, which I regard as a synonym. This species ranges down to the basal Kaiatan (5244, etc.), where it is common, but is not in the Tahuian or Bortonian; its upward limit seems to be Hutchinsonian.

The Lower Pliocene and Taranakian form differs from *mediocris* only in being not quite so flattened, more convex basally, still more sharply edged, and better defined dorsally, two coils with slightly limbate spiral and radial sutures being clearly visible, instead of an obscure central area with sutures definite for less than one coil; it may be called *Cibicides deliquatus* n.sp. (size, 0.9 mm.; type from 5408, near Nuhaka; Waitotaran silts). Upper Pliocene and Recent specimens are close but not quite the same.

Occurring with *mediocris* in the Lower Miocene is a related form, *Cibicides catillus* n.sp. (plate 67, fig. 200), still more compressed, with acute edge, faintly convex to concave on top without central swelling, little convex below, about 3 dorsal coils visible with 10 finely punctate chambers in last, early coils covered with translucent material, coils and chambers narrower, sutures much more curved, especially near outer edge, ventral sutures strongly curved medially, aperture weaker dorsally, running back for 3 chambers. Size, 0.8 mm.; type from 5699, basal Grey Marls, Weka Creek. This has been seen in Dunroonian (5636, 5692), "Blue Bottom" (5364, etc.), and rarely in Taranakian (3137).

***Cibicides ihungia* n.sp.** (Plate 67, figs. 201-206.)

Small, planoconvex, periphery fairly acute, dorsally flat or slightly concave, one coil visible, about 10 chambers; sutures slightly curved, directed back at 45°, heavily limbate but not much raised, centre entirely obscured by irregular mass of smooth shell substance, merging into limbation of spiral suture; non-limbate areas with moderate-sized perforations but no deep pits; ventral surface dome-shaped, slightly hollowed at centre, earlier chambers smooth with occasional small pits, last 4 or 5 with coarse distant punctae. Aperture normal, running back along suture for about 2 chambers. Umbilical plug thick, of darker substance. Size, 0.6 mm.

Type from 5846, Pourerere, Middle Ihungia. Enters in Dunroonian (5660, 5692), a few specimens in Lower Opoitian of Mangaruhe Stream, but rare at ends of range, common only in Hawke's Bay and Poverty Bay Ihungia. Related to *cicatricosa* Schw. but flat or concave on top, sides sloping inwards much more slowly below rather acute edge, more of base flattish, and especially much weaker ornament; Schwager's original figure shows very coarse pitting all over dorsal surface and most of base, and this is confirmed by Cushman's recent excellent figures of topotypes (*Trans. Pal. Soc. Japan*, vol. 46, p. 153, pl. 10, fig. 19, 1939). Specimens seen from the New Guinea Miocene (Upper Mena formation) are intermediate between the two species, with coarser punctae than *ihungia*.

***Cibicides verrucosus* n.sp.** (Plate 67, figs. 207-209.)

Dorsal surface flatly convex showing one coil (others obscured by papillae) with about 11 chambers, sutures slightly curved outwards, whole central portion covered with irregular coalescing papillae of moderate size, obscurely defined, rest of surface finely punctate; ventral surface lightly convex and smooth, with slightly curved sutures and translucent umbilical boss flush with surface. Size, 1.1 mm.

Type from 5678, base of Chalk Marl below Amuri Stone, Mid-Waipara; basal Kaiatan. Index of Kaiatan and Whaingaroan. This and *C. collinsi* are two of the most characteristic species of the Ototaran in all its facies. In the South Island they are almost always present, especially *verrucosus*, but have not been seen in the real Duntroonian or its equivalent the Weka Pass Stone. *C. collinsi* ranges down into Upper Bortonian in the South Island, and occasionally in the North (1014, Te Hua marl), but is usually replaced there by *C. tholus* Finlay. *C. verrucosus* is common in the Whaingaroan Weber formation, and seems to range in the North Island up into the Waitakian, occurring with *Cassidulina cuneata* in 5854 (Mangaotero S.D., pre-Ihungia mudstone).

Another papillose species is *Cibicides amoenus* n.sp. (plate 67, figs. 210, 211); much smaller, flatter, symmetrically convex with acute periphery bordered by narrow flange; 1 dorsal coil visible with 12 chambers, central papillae smaller, more numerous, distinct, hardly joined; chambers with conspicuous but fine punctae; ventral surface smooth, shining, with sinuous sutures; size, 0.6 mm.; type from G.S. 1240, Upper Ihungia. This is not common and seems confined to true Hutchinsonian. Specimens from the Upper Pliocene of New Guinea (Upper Ouba formation), however, seem inseparable.

***Cibicides collinsi* n.sp.**

Dorsal surface lightly convex, showing a little over 2 coils, with 8-9 chambers in last, sutures straight, inclined backwards at about 70°. Whole surface overlain with translucent shell substance, very thick centrally (through which early chambers show), penetrated by long, distant pores, absent over sutures. Ventral surface fairly convex, bluntly pointed at umbilicus, which is entirely filled with large translucent plug continued out into limbate sutures, chamber surface smooth, pores invisible at 36 magnification; aperture an arched opening on bluntly rounded periphery continued slightly back along dorsal suture. Size, 0.6 mm.

Type from 5635, Chalk Marl, lower part of Amuri limestone, Stoneyhurst S.D., Upper Bortonian. Ranges from here to Whaingaroan (5681, Mid-Waipara). Allied to *C. perlucida* Nuttall (*Journ. Pal.*, vol. 6, No. 1, p. 33, Pl. 8, f. 10-12, 1932), which has punctate base and angled edge.

***Discorbis scopos* n.sp.** (Plate 67, figs. 212, 213.)

Of the *bertheloti* type but much larger, with prominent proloculum forming a projecting bulb at dorsal centre, 6-7 chambers in last coil, number increasing on early whorls, a little inflated, with heavily limbate sutures except near periphery, which is marked by sharp limbate keel. Dorsally moderately convex, base lightly convex inside margin, excavated over the widely open umbilicus, which is filled with tongues projecting from base of chambers, hiding aperture, which barely reaches periphery in adults, turns over it (like *Cibicides*) in juveniles. Size, 1 mm.

Type from 5273, Awamoan, common at this horizon. In the Hutchinsonian (and Waitakian) is the related *Discorbis galerus* n.sp., differing only in smaller inconspicuous proloculum and especially the

excavated base, which is concave all over (occasionally quite flat), last chamber more spreading and embracing, upper surface regularly convex, not interrupted by the less limbate sutures. Size, 0.75 mm. Type from 5730, Pakaurangi Point lower beds; true Hutchinsonian.

In the basal zone (Duntroonian) of the Waitakian nearly always occurs a special form of this, *Discorbis turgidus* n.sp. (plate 67, figs. 214–216), differing only in the very high dorsal surface, the chambers so swollen that height is about two-thirds width, base flat, shell thicker and more compact; size, 0.55 mm.; type from 5660, *Waiparia elliptica* greensands at base of limestone, $\frac{1}{2}$ m. E. of Duntroon. It occurs up as far as Lower Hutchinsonian (5385, All Day Bay) in company with *galerus*, but has not been seen in true Hutchinsonian.

In the Bortonian a smaller relative, *Discorbis appositus* n.sp. (plate 67, figs. 217–221) is common; adults reach only two-thirds size of *scopos*, are especially much more compressed, the base flatly so; upper surface lightly rounded, limbate flange not far from medial in position; sutures heavily limbate, whorls a little swollen near umbilicus; size, 0.73 mm. Type from 5179B, Hampden, Upper Bortonian; also in Lower Bortonian (5540) and reaching Whaingaroan (1279).

In a few Bortonian faunas occurs *Discorbis jugosus* n.sp. (plate 67, figs. 222, 223) (type from 4266, Tangihanga, Poverty Bay, Upper Bortonian—also in 5102, 5776, Hawke's Bay), having 9–10 chambers in last coil with much thickened and raised sutures, larger than the chambers, especially swollen near wide umbilicus, merging into thick peripheral cord, top and bottom sub-equally flatly convex, aperture obscure, but apparently of this group, though chambers do not expand rapidly as in the other species; size, 0.9 mm. Seen only in Upper Bortonian of North Island; the Mexican Lower Tertiary *Cibicides cushmani* Nuttall (*Journ. Pal.*, vol. 4, no. 3, p. 291, Pl. 25, f. 3, 5, 6, 1930) is less symmetrical and has narrower chambers.

PARVICARININA n.gen. (Fam. Discorbidae).

Genotype: *Truncatulina tenuimargo* var. *alto-camerata* Heron-Allen and Earland.

This was described (*Terra Nova Exp.*, Zool., vol. 6, no. 2, p. 209, pl. 7, figs. 24–27, 1922) from 100 fathoms, 8 m. S. 14° W. of Big King Is. and noted to be well distributed. This is equally so for the Tertiary, and the species has a geological range back to Oligocene in company with the species usually called *Laticarinina pauperata*. It is not congeneric with either this species or with the real *tenuimargo*. When Brady described the latter (*Chall. Rep.*, vol. 9, p. 662, pl. 93, figs. 2, 3, 1884) he confused two very distinct forms; one from station 174A, Fiji (figs. 3a, b, c) and the other from West Coast of N.Z. The Indo-Pacific form (a *Cibicides*) has usually been regarded as typical; in case no rigid selection has yet been made, I now nominate this Fijian species (pl. 93, fig. 3) as *tenuimargo* s.str. On the strength of fig. 2, both species have been referred to under *Laticarinina*, but *pauperata*, though with similar chamber development and large flange, has an aperture just below edge of flange (on convex side), in a slight prolongation of chamber in direction of coiling. In passing, it may be mentioned that the well-known and world-wide specific name *pauperata* (" *Pulvinulina repanda* var.

menardii subvar. *pauperata*'' Parker and Jones, 1865) must apparently be replaced. The year previously Stache had described from our Oligocene Whaingaroa beds two species as *Robulina halophora* and *corona-lunae* (Voy. Novara, Pal., vol. 2, pp. 248 and 250, pl. 23, figs. 28 and 29). In the numerous faunas from at and near the type locality now seen there are no Cristellarians remotely like his figures, but large *pauperata* forms are abundant and can be matched with his pictures in every way, though fig. 28b is idealised. Compare even the flange ornament shown by him with the Challenger figures of Brady (pl. 104, figs. 4, 5). Specific discrimination seems impossible, and this Mid-Eocene to Recent form should henceforth be referred to as *Laticarinina halophora* (Stache). For comparison with Stache's and Brady's figures and Recent specimens, Whaingaroan specimens are here figured—a practical topotype from 1279 (plate 62, fig. 27), and Oxford Chalk examples from 5047 (plate 62, figs. 28, 29).

The aperture of *altocamerata*, however, is quite different. It is also a tubular extension of the chamber, not of the lower front face, however, but of the base, and coiled backwards to point in towards umbilicus at right angles to coiling (quite well shown in Brady's fig. 2a). Also, similar apertural tube openings are visible for several previous chambers, while *Laticarinina* has all chambers surrounded by translucent shell substance and opening only invisibly into each other. The normal form is here illustrated from the basal Waitakian of Weka Creek (5699; pl. 62, figs. 31, 33, 34), and one with an unusually wide carina from the Hutchinsonian of Whangara (3029; pl. 62, figs. 30, 32).

Another species of *Parvicarinina* seems to be *Discorbis plano-concava* (Parr) first described as a Recent variety of *Planulina biconcava* P. and J. (*Proc. Roy. Soc. Vic.*, vol. 42, pt. 1, p. 232, pl. 22, fig. 34, 1929), and later (*Journ. Linn. Soc. Zool.*, vol. 38, p. 561, pl. 11, fig. 40, 1934) referred to *Discorbis* by reason of an aperture which seems like *Parvicarinina*; it occurs in 60 fathoms off Poor Knights Is. but is not yet known as a fossil.

A rare and much more restricted species is *Parvicarinina deflata* n.sp., differing from *altocamerata* only in the compressed pinched-in chambers, the posterior sides concave; size, 0.4 mm. It has been seen in the Hutchinsonian (type from 5274, Marsden "Blue Bottom") and Taranakian (5703). Neither *Laticarinina* nor *Parvicarinina* occurs in our Cretaceous, though ubiquitous almost after; the former beginning in Upper Bortonian (3254), the latter not yet seen before Kaiatan (5601, 5182).

Allomorphina whangaia n.sp. (Plate 66, figs. 193-197.)

Small, inflated, sub-trigonal; spire very depressed, little raised above surface of last whorl, 3 closely knit chambers per coil. Somewhat bulbous, but base flattened, not globular as in *trochoides*; aperture at junction of chambers about half width of shell, hidden by thin sinuous lip projecting from last chamber. Size, 0.4 mm.

Type from 5698; index of Whangai and type Piripauan (5664, 5666, 5301, 3249, etc.). This has the depressed spire of *A. minuta* Cush. (*CCL*, 12, 4, p. 72, pl. 13, fig. 3, 1936), but is less compressed and has differently shaped chambers.

Globigerina circumnodifer n.sp. (Plate 65, figs. 150, 151.)

Large, loosely coiled, $4\frac{1}{2}$ chambers per coil, about 2 coils visible dorsally, ventrally nearly involute; spire flatly depressed, second coil more descending, chambers sub-globular, smooth, shining above and below but with faint peripheral sulcus margined by low nodules increasing in extent posteriorly to cover most of early chambers; umbilicus widely open, about one-third of shell diameter, aperture opening laterally into it, apertures of all ventral chambers probably visible if matrix absent. Size, 0.47 mm.

Type from 5698; Piripauan index. Evidently a close relative of the abundant Navarro *G. rugosa* Plummer (*Univ. Texas Bull.*, no. 2644, p. 38, pl. 2, fig. 10, 1926), which has 5 chambers per coil and more ornament of a different character. It is a moot point whether these are not *Globotruncana*, as they differ only in the absence of keels and feebler sculpture. The hard marl overlying the Waipawa black shale at Tanumi Bridge (5860) contains an abundance of *Gumbelina panikauia*, *Bolivinooides dorreeni* and *G. circumnodifer*; also a few examples of a true *Globotruncana* differing from the latter mainly in keeling and compression.

Sphaeroidinella disjuncta n.sp. (Plate 67, figs. 224-228.)

Rather small, 3 to 4 chambers in ventral view, the fourth usually small, outline roughly triangular. Resembles *Globigerina triloba*, but much more coarsely pitted, early chambers especially having numerous pustules; sutures deep, heavily channelled near umbilicus; aperture small, rounded, forming with umbilicus a deep cavity. A frequent tendency for last chamber to be smaller than others and somewhat jutting. Size, 0.58 mm.

Type from 4270, Upper Ihungia. Continues from here throughout Taranakian (e.g. 3114, Upper Poha). In many respects half-way between *Globigerina* and *Sphaeroidinella*, lacking the polish, pore appearance and compactness of *dehiscens*, but less like *Globigerina* in chamber attachment and deeply cleft sutures. In a sample from the Miocene Upper Mena series of New Guinea a very closely related species occurred together with the true *S. dehiscens*, both abundant, but only the latter was found in samples from the overlying Lower and Upper Ouba series (mostly Pliocene). True *dehiscens* occurs in New Zealand at least as low as Urenuian (5185, 5018).

LOCALITIES REFERRED TO MORE THAN ONCE IN TEXT OR PLATES.

- 1005—Taiporutu Stream, Mahia Peninsula.
 1279—Kariori S.D.; Whaingaroa clays, $1\frac{1}{2}$ m. S.E. of Raglan, below basalt.
 3029—Beach S. of Whangara, sandy marl between two massive marls.
 3249—Waipiro S.D., calcareous sandstone bands in marls.
 3250A—Waipiro S.D., mouth of Tuparoa Stream, marls in siliceous shale.
 3270—Mangaoporo S.D., upper Mangaoporo Stream, basal Rakauroa.
 3286—Turanganui S.D., Pouawa Dome, sandy marl.
 3312—Hobson's Bay, Auckland, Waitemata beds (= Orakei Bay).
 4270—Waikohu S.D., Tangihanga.
 5018—Hangaroa Stream, type Poha Section, 400 ft. below top.

- 5047—Oxford Chalk, N. Canterbury.
 5056—Takaka, Terakohe marl quarry, above bryozoan bed.
 5105—Citrini's Area, near Kumara.
 5132—Waiiau River, Clifden, Southland; band 5, first marl outcrop above limestone.
 5179A—Hampden beach, 1 m. N. of Kakaho Creek.
 5179B—Hampden beach, 1½ m. N. of Kakaho Creek.
 5182—Jackson's paddock, Oamaru, 1 m. S.W. of Cormack's Station, lower part of limestone.
 5207—Eketahuna marl, roadside, first exposure S. of town.
 5273—All Day Bay marl, Kakanui beach, 60 chs. at 153° from Trig V.
 5276—Marsden "Blue Bottom," 6 m. S. of Greymouth, marl.
 5300—Moeraki S.D., soft white marl at S. end of beach (McKay's marly clay).
 5338—Mangaotero S.D., 175 ch. at 74° from Trig U.
 5374—Mangaotero S.D., 148 ch. at 61° from Trig U.
 5382—Porangahau S.D., 210 ch. at 84° from Trig U.
 5540—Hampden beach, 22 ch. at 162° from Trig H, Lower Bortonian marl, just above glauconite.
 5557A—Cheviot S.D., Kaikoura; marl 30 ch. S.W. of Trig sub Y.
 5561—Cheviot S.D., Caroline Creek, 70 ch. E.N.E. from Trig sub B.
 5601—Kaiata marl, lower part.
 5698—Panikau Dome, Whangara, siliceous marl.
 G.S. 475—Mount Harris, Waihao River, marly sandstone.
 G.S. 1155—Hicks Bay, sandstone with *Cucullaea*.
 G.S. 1240—Ihungia marl, Island Creek, Tutamoe S.D.
 G.S. 1342—Waikura Stream, Putatahi S.D., basal Tutamoe.

LIST OF NEW NAMES PROPOSED.

(For age equivalents see Finlay, 1939, *Trans. Roy. Soc. N.Z.*, vol. 68, pt. 4, p. 531.)

GENERIC.

- Conotrochammia* n.gen. (Fam. Ammodiscidae). Genotype: *C. whangaia* n.sp. (Uppermost Cretaceous).
Karrerulina n.subgen. (Fam. Valvulinidae). Genotype: *Gaudryina apicularis* Cushman. (Turonian or earlier—Recent).
Parvicarinina n.gen. (Fam. Discorbidae). Genotype: *Truncatulina tenuimargo* var. *altocamerata* Herron-Allen and Earland (Lower Oligocene—Recent).

SPECIFIC.

- Conotrochammia whangaia* n.sp. (Campanian, perhaps to Danian).
Cyclammia grangei n.sp. (Upper Cretaceous to Eocene).
Siphotextularia kreuzbergi n.sp. (Lower to Middle Miocene).
Siphotextularia ihungia n.sp. (Lower Miocene).
Siphotextularia subcylindrica n.sp. (Upper Miocene).
Gaudryina minuscula n.sp. (Lower Oligocene, Lower Miocene?).
eggerella columna n.sp. (Uppermost Cretaceous).
eggerella ihungia n.sp. (Lower Miocene).
Dorothia elongata n.sp. (Santonian).
Karrerulina bortonica n.sp. (Mid-Eocene to Oligocene).

- Karrerulina aegra* n.sp. (Danian to Lower Mid-Eocene).
Karrerulina clarentia n.sp. (Turonian).
Karrerella cushmani n.sp. (Upper Oligocene to Middle Miocene).
Karrerella cylindrica n.sp. (Upper Miocene to Lower Pliocene).
Nodosaria subtetragona n.sp. (Lower to Upper Miocene).
Nodosaria sinalata n.sp. (Upper Miocene to Lower Pliocene).
Nodosaria (?) *multicostales* n.sp. (Lower Pliocene).
Amphicoryne prora n.sp. (Mid-Oligocene to Upper Miocene).
Gumbelina panikauia n.sp. (Santonian).
Gumbelina ototara n.sp. (Oligocene).
Bolivinoidea dorreeni n.sp. (Santonian).
Rectobolivina hangaroana n.sp. (Uppermost Miocene).
Bulimina miolaevis n.sp. (Lower Miocene).
Bulimina mapiria n.sp. (Uppermost Miocene).
Bulimina rakauroana n.sp. (Santonian).
Bulimina senta n.sp. (Lower to Upper Miocene).
Bulimina truncanella n.sp. (Mid-Eocene to Upper Miocene).
Bulimina bremneri n.sp. (Lower to Middle Miocene).
Bulimina forticosta n.sp. (Upper Mid-Eocene to Mid-Oligocene).
Bulimina pahiensis n.sp. (Upper Mid-Eocene).
Bulimina scobinata n.sp. (Mid to Upper Oligocene).
Cassidulina cuneata n.sp. (? Upper Oligocene, Lower to Upper Miocene).
Nonion iota n.sp. (Mid-Eocene to Lower Oligocene).
Nonionella magnalingua n.sp. (Upper Oligocene to Lower Pliocene).
Nonionella zenitens n.sp. (Eocene to Middle Miocene).
Nonionella satiata n.sp. (Middle Miocene).
Nonionella tanumia n.sp. (Santonian).
Anomalina visenda n.sp. (Mid-Eocene).
Anomalina aotea n.sp. (Upper Cretaceous to Mid-Oligocene, perhaps later).
Anomalina vitrinoda n.sp. (Mid-Oligocene to Upper Miocene).
Anomalina semiteres n.sp. (Mid-Eocene to Lower Oligocene).
Anomalina miosuturalis n.sp. (Upper Oligocene to Mid-Miocene).
Anomalina eosuturalis n.sp. (Mid-Eocene to Mid-Oligocene).
Anomalina subnonionoides n.sp. (Upper Oligocene to Mid-Miocene).
Anomalina spherica n.sp. (Upper Miocene to Recent).
Anomalina pinguiglabra n.sp. (Upper Oligocene to Mid-Miocene).
Anomalina macraglabra n.sp. (Upper Oligocene to Middle Miocene).
Anomalina eoglabra n.sp. (Campanian to Mid-Oligocene).
Anomalina parvumbilia n.sp. (Lower Miocene to Middle Pliocene).
Streblus aoteanus n.sp. (Lower Pliocene to Recent).
Gyroidina infra fossa n.sp. (Santonian to Campanian).
Nuttallides tholus n.sp. (Santonian).
Pulvinulinella acutimarginata n.sp. (Santonian to Campanian).
Pulvinulinella creta n.sp. (Santonian to Campanian).

- Cancris amplus* n.sp. (Lower Miocene to Lowest Pliocene).
Cancris brevior n.sp. (Lower Miocene).
Cancris lateralis n.sp. (Upper Oligocene to Middle Miocene).
Cancris compressus n.sp. (Upper Mid-Eocene to Middle Oligocene).
Cancris maoricus n.sp. (Recent).
Cibicides mediocris n.sp. (Upper Oligocene to Middle Miocene).
Cibicides deliquatus n.sp. (Upper Miocene to Lower Pliocene).
Cibicides catillus n.sp. (Upper Oligocene to Upper Miocene).
Cibicides ihungia n.sp. (Upper Oligocene to Lowest Pliocene).
Cibicides verrucosus n.sp. (Lower to Upper Oligocene, Waitakian?).
Cibicides amoenus n.sp. (Lower Miocene).
Cibicides collinsi n.sp. (Upper Mid-Eocene to Mid-Oligocene).
Discorbis scopos n.sp. (Middle Miocene).
Discorbis galerus n.sp. (Upper Oligocene to Lower Miocene).
Discorbis turgidus n.sp. (Upper Oligocene).
Discorbis appositus n.sp. (Eocene to Middle Oligocene).
Discorbis jugosus n.sp. (Upper Mid-Eocene).
Parvicarinina deflata n.sp. (Lower to Upper Miocene).
Allomorphina whangaia n.sp. (Santonian to Campanian).
Globigerina circumnodifer n.sp. (Santonian).
Sphaeroidinella disjuncta n.sp. (Lower to Upper Miocene).