

ART. XI.—*Notes on Australian and New Zealand Foraminifera.*
No. 3: Some Species of the Family Polymorphinidae

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Introduction.

Prior to the publication of Cushman and Ozawa's paper "An Outline of a Revision of the Polymorphinidae" in 1928, the genus *Polymorphina* was used to include, as its name would suggest, a series of foraminifera presenting great diversity of form. Cushman and Ozawa found that the genus included forms which had developed along a number of lines and showed that most of the species hitherto placed in *Polymorphina* should be distributed among a number of genera, several of which had been for many years disused, and other new genera which they erected.

The "Outline" was followed in 1930 by their publication of "A Monograph of the Foraminiferal Family Polymorphinidae, Recent and Fossil." In this work, probably the largest and most comprehensive ever devoted to a single family of the foraminifera, Cushman and Ozawa reviewed the known species of the family and described many others, including a number from the Australian region.

The publication of the "Monograph" has made the present work possible and the writers acknowledge their indebtedness to its authors, one of whom, to the great loss of all workers on the foraminifera, has since passed away.

In this paper, the writers give the results of the study of several thousand specimens of the Polymorphinidae, both fossil and Recent, from Australia and New Zealand. A representative set of samples from the Victorian Tertiary deposits has been examined as well as a quantity of material from the Tertiary of New Zealand. Eight genera and 35 species and varieties are recorded, including ten species and varieties described as new. The new forms are—

Guttulina regina (Brady, Parker, and Jones), var. *chapplei*,
var. nov.

Guttulina clifdenensis, sp. nov.

Pyrulina crespinae, sp. nov.

Pseudopolymorphina doanei (Galloway and Wissler), var.
beaumarisensis, var. nov.

Pseudopolymorphina tasmanica, sp. nov.

Polymorphina myrae, sp. nov.

Sigmomorphina haeusleri, sp. nov.

S. wynyardensis, sp. nov.

S. batesfordensis, sp. nov.

Sigmoidella novozealandica, sp. nov.

All of these new forms are restricted in their distribution, and the fossil forms should therefore be of value to the micro-palaeontologist.

Description of the Species.

Family POLYMORPHINIDAE d'Orbigny, 1846.

Sub-family POLYMORPHININAE Brady, 1881.

Genus **Guttulina** d'Orbigny, 1826.

GUTTULINA PROBLEMA d'Orbigny.

(Plate XII., Fig. 1.)

Guttulina problema d'Orbigny, 1826, p. 266, No. 14. Cushman and Ozawa, 1930, p. 19, pl. ii., figs. 1-6; pl. iii., figs. 1a-c.

According to Cushman and Ozawa, this species has a very wide distribution, both geographically and geologically. The earliest record given by these authors is from the Cretaceous and it is noted as occurring upwards to present-day seas. They give records from the Miocene of the Filter Quarry, Batesford, and from Bird Rock Cliffs and Danger Point, both at Torquay, Victoria.

Localities.

Upper Eocene.—New Zealand: Motutara Point, Kawhia Harbour (from Whaingaroa Series).

Oligocene.—New Zealand: Otiake; Gore; Waitaki Valley.

Miocene.—Victoria: Lake Wellington bore, 1,100-1,138 feet; Vic. Geol. Survey bore, Parish of Meerlieu, 1,200 feet; Mines Department bore, Parish of Nuntin, 1,453 feet; Castle Cove (upper beds); road cut, Ford River, west of Cape Otway; Point Danger, Torquay; The Ledge, Bird Rock Cliffs, Torquay; Rocky Point, north end of Bell's Beach, Torquay; Wauru Ponds; Lower Beds, Muddy Creek; Vic. Geol. Survey bore, Hamilton, 80-85 feet; Filter Quarry, Batesford; Maude (upper bed); Western Beach, Geelong; shell lime pit, east of Longford; Robertson's Quarry, Longford; Vic. Geol. Survey bore, Parish of Moormurng, 716 feet; railway cutting, Neumerella; Flinders; west side of mouth of Curdie's Inlet. Tasmania: Table Cape. Western Australia: Cape Range.

Pliocene.—Victoria: Beaumaris; Jemmy's Point, Lakes Entrance; Forsyth's, Grange Burn.

Recent.—Victoria: San Remo. Tasmania: Oyster Bay; east of Cape Pillar, 100 fms.

GUTTULINA IRREGULARIS (d'Orbigny).

(Plate XII., Fig. 2.)

Globulina irregularis d'Orbigny, p. 226, pl. xiii., figs. 9, 10.*Guttulina irregularis* (d'Orb.): Cushman and Ozawa, 1930, p. 25, pl. iii., figs. 4, 5; pl. vii., figs. 1, 2.

Typical examples are of frequent occurrence. A costate form of this species was met with in a bore sample from Mines Department boring, Parish of Nuntin, near Longford, Victoria, depth 1,453 feet.

The time range of *G. irregularis* is stated by Cushman and Ozawa to be from Eocene to Recent and it has also a wide geographical distribution. They record it as a fossil from the Miocene of Victoria and as a Recent form from Bass Strait and from around New Zealand.

Localities.

Upper Eocene.—New Zealand: Motutara Point, Kawhia Harbour (Whaingaroa Series).

Oligocene.—New Zealand: Clifden, Southland (Horizons 4 and 6c).

Miocene.—Victoria: sea floor, Apollo Bay; Castle Cove (upper beds); Alkemade's Quarry, Kawarren; Flinders; Filter Quarry, Batesford; lower beds, Muddy Creek; Mines Department bore, Parish of Nuntin, 1,453 feet (costate var.); Beaumaris (lower beds). Tasmania: Table Cape. New Zealand: Orakei Bay, Auckland.

GUTTULINA YABEI Cushman and Ozawa.

(Plate XIII., Figs. 3, 4a-c; Plate XIII., Figs. 4a-c.)

Polymorphina oblonga Brady (non *P. (Guttulina) oblonga* d'Orb.), 1884, pl. lxxiii., figs. 2, 3.*Guttulina yabei* Cushman and Ozawa, 1929, p. 68, pl. xiii., fig. 2; pl. xiv., fig. 6; 1930, p. 30, pl. iv., figs. 6, 7.

This species varies a good deal in shape, apparently being affected by its environment. Very large characteristic examples occur in the Oligocene (Hutchinsonian) of Otiake, New Zealand. The Recent specimens we have are, with the exception of some from off the east coast of Tasmania, smaller and slenderer, but the general arrangement of the chambers is as in the more typical form of *G. yabei*. A particularly slender form is figured from off Black Rock, Victoria (Plate XII., figs. 4a-c). At this locality all of the foraminifera are undoubtedly affected by the discharge of fresh water from the River Yarra into Hobson's Bay as they are thin shelled and otherwise atypical. Chapman (1909, Pl. X., fig. 2) has figured the same form from shore sand, Beaumaris, under the name of *Polymorphina thouini* d'Orb. *P. thouini* is, however, now placed in *Pyrrulina*.

G. yabei was described from the Upper Pliocene, Sawane, Island of Sado, Japan, and Cushman and Ozawa record it from two *Albatross* soundings, at depths of 44 and 114 fathoms respectively, off Japan. The specimens figured by Brady in the above reference as *Polymorphina oblonga* were from Bass Strait, 38-40 fathoms, and Port Jackson, 6 fathoms.

Localities.

Oligocene.—New Zealand: Gore, Southland; Clifden, Southland (Horizons 6a and 6c); Otiake.

Pliocene.—New Zealand: Maraekakaho, Hawkes Bay.

Recent.—Victoria: Shore sand, San Remo; shallow water, Black Rock. Tasmania: Oyster Bay. New South Wales: Watson's Bay, Port Jackson. New Zealand: 60 miles east of Lyttleton, 100 fathoms; 14 miles north-east of Auckland Island, 95 fathoms; off the Snares, 60 fathoms.

GUTTULINA sp.

(Plate XIII., Figs. 1a-c.)

The only example of this species is from the Upper Cretaceous of Gingin, Western Australia. It appears to be new, but its naming has been deferred until more material is available. The test is fusiform and the chambers are arranged in a quinqueloculine series; the sutures are depressed. The specimen is 1.18 mm. in length, with a major diameter of 0.56 mm. and a minor diameter of 0.54 mm. It resembles *G. woodsi* Cushman and Ozawa from the Upper Cretaceous of England, but that species is more regularly fusiform and tapers sharply to each end.

GUTTULINA REGINA (Brady, Parker, and Jones).

(Plate XII., Fig. 5; Text-figs. 1-7.)

Polymorphina regina Brady, Parker, and Jones, 1870, p. 241, pl. xli., figs. 32a, b; Chapman, 1909, p. 132, pl. x., fig. 4.

Guttulina regina (B., P., & J.): Cushman and Ozawa, 1930, p. 34, pl. vi., figs. 1, 2.

This species was described from Storm Bay, Tasmania, and it is a common form in moderately shallow water on the eastern and southern coasts of Australia. Cushman and Ozawa note it also occurs in the Philippines. It may be observed that *G. regina* does not appear to have ever been recorded from New Zealand waters. Several other species, notably *Sigmoidella kagaensis*, and probably also *S. elegantissima*, are similarly confined in Recent seas, to Australian and Eastern Asiatic waters.

As a rule *G. regina* is fairly consistent in form, any variation being in the direction of a more attenuated shell, or in the degree of fineness of the costation. In a number of shore gatherings, made at Barwon Heads, Victoria, by Mr. W. Baragwanath, the Director of the Geological Survey of Victoria, the specimens of

G. regina exhibit a number of unusual variations, some of which are figured (Text-figs. 1-7). It will be noted that *Pseudopolymorphina*- and *Polymorphinella*-like forms are present. The only explanation of these curious forms is that the River Barwon discharges into Bass Strait at this point, and that the influx of fresh water has affected the normal growth of *G. regina* in the vicinity.

Localities.

Oligocene.—New Zealand: Clifden, Southland (Horizons 4 and 6c).

Miocene.—Victoria: Road cut, Ford River, west of Cape Otway; Vic. Geol. Survey bore, Hamilton, 80-85 feet. Tasmania: Table Cape.

Pliocene.—Victoria: Beaumaris.

Recent.—Victoria: Inverloch; Barwon Heads; Point Lonsdale; Altona Bay. New South Wales: Watson's Bay, Port Jackson. Queensland: *Challenger* Stn. 185, off Raine Island, 155 fathoms. Tasmania: Burnie; Devonport. South Australia: Glenelg. Western Australia: *Bonthorpe* sounding, Great Australian Bight, lat. 33° 14' S., long. 126° 16' E., 89 fathoms.

GUTTULINA REGINA (Brady, Parker, and Jones), var.

CRASSICOSTATA Cushman and Ozawa.

(Plate XII., Fig. 6.)

Guttulina regina, var. *crassicostata* Cushman and Ozawa, 1930, p. 35, pl. xi., figs. 5a-c.

This variety was separated from *G. regina* because of the very broad, coarse costae and more regularly fusiform test, with the chambers less inflated than in the typical form. It was described from the Lower Pliocene of Beaumaris, Victoria. The present specimens are from the type sample. This variety of *G. regina* is of common occurrence in the Lower Pliocene of Beaumaris, but has not been met with elsewhere.

GUTTULINA REGINA (Brady, Parker, and Jones), var. CHAPPLEI, var. nov.

(Plate XII., Figs. 7a-c.)

The variety differs from typical *G. regina* in the very short, thick test, more embracing chambers, less depressed sutures, and heavy costae, as coarse as those of var. *crassicostata*.

Length of holotype of variety, 0.95 mm.; breadth, 0.83 mm.; thickness, 0.70 mm.

Holotype (Parr Coll.) from Lower Miocene, Fisher's Point, west of Cape Otway, Victoria, collected by Rev. E. H. Chapple, in honour of whom the variety is named. This form has only been met with at the type locality, and is of rare occurrence.

GUTTULINA COSTULATA (Cushman).

(Plate XII., Figs. 9a-c.)

Polymorphina cuspidata Brady, var. *costulata* Cushman, 1922, p. 133, pl. xxxi., fig. 1.

Guttulina costulata (Cush.): Cushman and Ozawa, 1930, p. 48, pl. xii., figs. 3a, b.

Cushman reported *G. costulata* from the Lower Oligocene, Mint Spring Marl, Mint Spring Bayou, Vicksburg, Missouri, U.S.A. Cushman and Ozawa note that specimens which seem identical occur in the Lower Pliocene of Beaumaris, Victoria. Our examples are from the same locality, where it is common.

GUTTULINA LACTEA (Walker and Jacob).

(Plate XII., Fig. 8.)

Serpula lactea Walker and Jacob (*vide* Kanmacher), 1798, p. 634, pl. xiv., fig. 4.

Guttulina lactea (W. & J.): Cushman and Ozawa, 1930, p. 43, pl. x., figs. 1-4.

The present examples compare well with specimens from Dog's Bay, Ireland. The maximum dimensions given by Cushman and Ozawa for the species—viz., length, 0.85 mm.; breadth, 0.40 mm.; thickness, 0.28 mm.—are exceeded by those of the figured specimen. These, given in the same order, are 1.08 mm.; 0.65 mm.; 0.38 mm.

Cushman and Ozawa's records of *G. lactea* are nearly all from the Atlantic Ocean and Tertiary deposits in Europe. Pacific records are, however, given by them from the Philippine Islands (Recent) and Japan (Pliocene).

Localities.

Lower Pliocene.—Victoria: Beaumaris (fistulose examples).

Recent.—Victoria: Shore sand, Barwon Heads.

GUTTULINA LACTEA (Walker and Jacob), var. *EARLANDI*
Cushman and Ozawa.

(Plate XV., Figs. 9a and c.)

Guttulina lactea (Walker and Jacob), var. *earlandi* Cushman and Ozawa, 1930, p. 45, pl. x., fig. 5.

This variety differs from typical *G. lactea* in being attached instead of free. According to Cushman and Ozawa, it has been found Recent in the Mediterranean and at Selsey, England, and as a fossil in the Pliocene (Crag) of Sutton, England. The present example is from the Lower Miocene of Muddy Creek, Victoria.

GUTTULINA YAMAZAKII Cushman and Ozawa.

(Plate XIII., Figs. 5a-c.)

Guttulina yamazakii Cushman and Ozawa, 1930, p. 40, pl. viii., figs. 3, 4.

The present specimens, from the Lower Pliocene of Beaumaris, Victoria, agree well with Cushman and Ozawa's figures and description of this species, from off Cape Tsuika, Japan, and also recorded as a fossil from the Pliocene of Japan.

GUTTULINA CLIFDENENSIS, sp. nov.

(Plate XV., Figs. 7a-c.)

Test roughly triangular in front view, with rounded edges and angles, except the pointed apertural end; chambers embracing, elongated, and narrowing towards the apertural end, arranged in a quinqueloculine series; sutures distinct, not depressed; wall smooth, thick; aperture radiate.

Length of holotype, 1.15 mm.; width, 0.85 mm.; thickness, 0.55 mm.

Holotype (Parr Coll.) from Oligocene (Hutchinsonian), Horizon 6a, Clifden, Southland, New Zealand, collected by Dr. C. R. Laws.

In end view this species resembles *G. lehneri* C. and O., but is otherwise quite different. *G. irregularis* (d'Orb.), var. *nipponensis* C. and O., is somewhat similar in side view, but is triangular in section.

The only specimens of *G. clifdenensis* are from the type locality.

GUTTULINA SEGUENZANA (Brady).

(Plate XII., Figs. 10a and c.)

Polymorphina seguenzana Brady, 1884, p. 50, pl. lxxii., figs. 16, 17.*Guttulina* (*Sigmoidina*) *seguenzana* (Brady): Cushman and Ozawa, 1930, p. 50, pl. xxxvii., figs. 8, 9 (after Brady).

A very typical example of this rare species is figured. *G. seguenzana* also occurs in Bass Strait, where the specimens are more robust, but otherwise typical, only three chambers being visible and the lower ends of the two outside chambers embracing the base of the third chamber.

The only previous records of this species appear to be those given by Brady, viz., off the Ki Islands, south-west of New Guinea, 129 fathoms, and Port Jackson, New South Wales, 2-10 fathoms, in dredgings made by H.M.S. "Challenger."

Localities.

Recent.—Victoria: Shore sand, Inverloch and San Remo. Tasmania: Shore sand, Devonport. New South Wales: Dredgings, 22 miles east of Narrabeen, 80 fathoms.

GUTTULINA SILVESTRII Cushman and Ozawa.

(Plate XII., Fig. 11.)

Guttulina (Sigmoidina) silvestrii Cushman and Ozawa, 1930, p. 51, pl. xxxvii., figs. 6, 7.

This species was described from the Lower Miocene of the Filter Quarry, Batesford, Victoria, and also recorded by Cushman and Ozawa as a Recent form from South Australia and New Zealand. The only specimen we have met with resembling *G. silvestrii* is figured. This is from the type locality and is fairly close to the type figure. It is possible that other specimens have been confused with *Sigmoidella elegantissima*, from which it is difficult to separate without examining the shell from both sides.

Genus **Pyrulina** d'Orbigny, 1826.

PYRULINA FUSIFORMIS (Roemer).

(Plate XIII., Figs. 2a-c, 3a-c; Plate XIV., Figs. 5a-c.)

Polymorphina fusiformis Roemer, 1838, p. 386, pl. iii., fig. 37.

P. angusta Brady (non Egger), 1884, p. 563, pl. lxxii., figs. 1-3; Chapman and Parr, 1926, p. 392, pl. xxi., fig. 75.

Pyrulina fusiformis (Roemer): Cushman and Ozawa, 1930, p. 54, pl. xiii., figs. 3-8.

Cushman and Ozawa's figures and synonymy indicate a considerable range of variation. A stout form comparable with their figure 8, and a slender form near their figure 4, are represented on Plate XIII., figs. 2 and 3 respectively. The slender form was recorded by Chapman and Parr (*loc. cit.*) under the name of *Polymorphina angusta* from the Tertiary (Balcombian) of the Altona Bay coal shaft.

Plate XIV., Fig. 5, represents what appears to be a species of *Pseudopolymorphina*, near *P. jonesi* C. and O. The arrangement of the early chambers indicates, however, that it is the slender form of *P. fusiformis*, but with the addition of two uniserial chambers. In end view the two forms are identical. They invariably occur together, but the pseudopolymorphine type of shell is rarely met with.

Localities.

Oligocene.—New Zealand: Clifden, Southland (Horizon 6c).

Miocene.—Victoria: Castle Cove (upper beds); road cut, Ford River, west of Cape Otway; Vic. Geol. Survey borings, Hamilton, 80-85 feet. and Parish of Meerlieu, 1,200 feet; Flinders; Mines Department bore, Parish of Nuntin, 1,453 feet; Grice's Creek; Altona Bay coal shaft; The Ledge, Bird Rock Cliffs, Torquay. Tasmania: Table Cape.

PYRULINA CYLINDROIDES (Roemer).

(Plate XIII., Figs. 7a-c.)

Polymorphina cylindroides Roemer, 1838, p. 385, pl. iii., fig. 26.*P. rugosa* d'Orbigny, var. *horrida* Chapman and Parr (*non Globulina horrida* Reuss), 1926, p. 392, pl. xxi., figs. 78, 79.*Pyrulina cylindroides* (Roemer): Cushman and Ozawa, 1930, p. 56, pl. xiv., figs. 1-5.

As a rule this species has a smooth wall and is not fistulose, but the greater number of specimens here attributed to *P. cylindroides* from the Miocene of Victoria have the wall covered with short prickles, and the apertural end of the test is fistulose. Cushman and Ozawa have figured a somewhat similar example from the Cretaceous, Cambridge greensand, of Cambridge, England. This is apparently megalospheric, while the specimen here figured is probably microspheric. Both smooth and prickly forms occur together at Western Beach, Geelong, in beds of Miocene age. The smooth forms are similar to Cushman and Ozawa's Figs. 1 and 2.

Localities.

Miocene.—Victoria: The Ledge, Bird Rock Cliffs, Torquay (smooth form); Vic. Geol. Survey borings, Parish of Moormurung, 716 feet (prickly form), and Hamilton, 80-85 feet (prickly form); Curlewis (prickly form); Orphanage Hill, Geelong (smooth form); Western Beach, Geelong (smooth and prickly forms); Red Bluff, Shelford (prickly form); Grice's Creek (prickly form); Kackeraboite Creek (prickly form); Balcombe Bay (prickly form).

Pliocene.—Victoria: Beaumaris (smooth form).

Recent.—New Zealand: 60 miles east of Lyttleton, 100 fathoms; 14 miles north-east of Auckland Island, 95 fathoms (all smooth).

PYRULINA CRESPINAE, sp. nov.

(Plate XIV., Figs. 1a-c.)

Test cylindrical, elongated, rounded at the base; chambers about two and a half times as long as wide, very slightly inflated, at first arranged in a quinqueloculine series but becoming biserial in the later portion of the shell, each succeeding chamber removed further from the base; sutures little, if at all, depressed, distinct; wall smooth, translucent; aperture radiate.

Length of holotype, 1.40 mm.; major diameter, 0.35 mm.; minor diameter, 0.26 mm.

Holotype (Parr Coll.) from Lower Pliocene, Beaumaris, Victoria, collected by W. J. Parr.

This slender species recalls *Pyrulina thouini* (d'Orbigny), but is widest in the later part of the test and does not take on the biserial character as soon as d'Orbigny's species.

One finely costate example of *P. crespinae* was met with. The species is named in honour of Miss Irene Crespin, B.A., the Commonwealth Palaeontologist. It has occurred only in the Lower Pliocene of Beaumaris.

Genus **Globulina** d'Orbigny, 1826.

GLOBULINA GIBBA d'Orbigny.

(Plate XII., Fig. 12.)

Globulina gibba d'Orbigny, 1826, p. 266, No. 10, Modèles No. 63; Cushman and Ozawa, 1930, p. 60, pl. xvi., figs. 1-4.

Cushman and Ozawa state that, unlike many species of foraminifera, this species died out in the Pacific region and only persisted in the Atlantic and Mediterranean. *G. gibba* is very well represented in the Tertiary of Victoria and the examples attain a length of as much as 2.9 mm. As a rule, the large specimens exhibit traces of having been apically fistulose.

Localities.

Miocene.—Victoria: Mines Department bore, Parish of Nuntin, 1,453 feet; sea floor, Apollo Bay; Point Danger, Torquay; The Ledge, Bird Rock Cliffs, Torquay; Rocky Point, north end of Bell's Beach, Torquay; Vic. Geol. Survey borings, Parish of Meerlieu, 1,200 feet, Parish of Moormurung, 716 feet, and Hamilton, 80-85 feet; Castle Cove (upper beds); road cut, Ford River, west of Cape Otway; Flinders; Filter Quarry, Batesford; Wauru Ponds; Western Beach, Geelong; Grice's Creek; Altona Bay coal shaft; railway cutting, Neumerella; cliffs, west side of mouth of Curdie's Inlet; Beaumaris (lower beds). Tasmania: Table Cape.

Pliocene.—Victoria: Beaumaris; McDonald's, Muddy Creek.

GLOBULINA GIBBA d'Orbigny, var. **GLOBOSA** (Münster).

(Plate XII., Fig. 13.)

Polymorphina globosa von Münster in Roemer, 1838, p. 386, pl. iii., fig. 33.

Globulina gibba d'Orbigny, var. *globosa* (v. Münster): Cushman and Ozawa, 1930, p. 64, pl. xvii., figs. 8, 9.

Cushman and Ozawa give the geological range of this compressed modification of *G. gibba* from Eocene to Recent. Their fossil records are from Europe and North America. The only Indo-Pacific record given by these authors is as a Recent form from shore sand, Torquay, Victoria. What appears to be the same form is of common occurrence in shore sands at Torquay, Barwon Heads, and Point Lonsdale, Victoria. We have other examples, also from shore sands, from Burnie and Devonport, Tasmania, and Glenelg, South Australia.

Genus **Pseudopolymorphina** Cushman and Ozawa, 1928.

PSEUDOPOLYMORPHINA DOANEI (Galloway and Wissler).

(Plate XIV., Figs. 2a-c.)

Polymorphina doanei Galloway and Wissler, 1927, p. 54, pl. ix., fig. 8.

Pseudopolymorphina doanei (G. & W.): Cushman and Ozawa, 1930, p. 95, pl. xxiv., figs. 5a, b.

The figured specimen is shorter than others which have since been obtained, also from the Lower Pliocene of Beaumaris. These closely match Cushman and Ozawa's figures of this species. Previous records have been from the Pleistocene and Pliocene of California. We have examples from one of Galloway and Wissler's localities, viz., San Pedro, California, and all of the present specimens agree with these.

Localities.

Oligocene.—New Zealand: Otiake.

Lower Pliocene.—Victoria: Beaumaris.

PSEUDOPOLYMORPHINA DOANEI (Galloway and Wissler), var.
BEAUMARISENSIS, var. nov.

(Plate XIV., Fig. 3.)

Variety differing from the typical form of *P. doanei* in having the earlier two-thirds of the test covered with fine longitudinal striae.

Length of figured specimen, 1.35 mm.; breadth, 0.60 mm.; thickness, 0.45 mm.

Holotype of variety (Parr Coll.) from Lower Pliocene of Beaumaris, Victoria, collected by W. J. Parr. It appears to be confined to this locality, and is of rare occurrence.

PSEUDOPOLYMORPHINA TASMANICA, sp. nov.

(Plate XIV., Figs. 6a-c.)

Test about two and a half times as long as broad, almost circular in section, rounded at both ends; chambers rounded, only slightly embracing, arranged at first in a quinqueloculine series, becoming biserial in the later part of the test; sutures strongly depressed, distinct; wall smooth; aperture radiate.

Length of holotype, 1.40 mm.; breadth, 0.50 mm.; thickness, 0.45 mm.

Holotype (Parr Coll.) from Lower Miocene (*Crassatella* bed), Table Cape, Tasmania, collected by W. G. Parr.

This species resembles *P. doanei*, but differs from that species in having a more loosely built test, with longer chambers. The chambers in the guttuline series are less embracing whilst those

in the biserial portion extend across the test almost to the other side, instead of only to the vicinity of the median line, as in *P. doanei*.

The only specimens of *P. tasmanica* are from the type locality, where it is rare.

PSEUDOPOLYMORPHINA RUTILA (Cushman), var. PARRI Cushman and Ozawa.

(Plate XIV., Figs. 4a-c.)

Pseudopolymorphina rutila (Cushman), var. *parr*i Cushman and Ozawa, 1930, p. 100.

Test compressed, elongate, fusiform, with the initial end pointed; chambers elongated, not much embracing, alternating in the later part of the test; sutures distinct, slightly depressed; wall with a few strong longitudinal costae; aperture radiate.

Length of figured specimen, 1.43 mm.; breadth, 0.45 mm.; thickness, 0.25 mm.

This form differs from *P. rutila*, of the Lower Oligocene (Byram Marl) of the United States, in its broader test and coarser costae. It was described, but not figured, by Cushman and Ozawa from material sent to Dr. Cushman by Parr. The specimens now recorded are from the type sample, collected by Parr from the soapy clay bed occurring in the polyzoal limestone at Rocky Point, Torquay. This is not the Rocky Point known to most visitors to Torquay, on the south side of the mouth of Spring Creek, but is at the north end of Bell's Beach, about 1 mile south of Bird Rock. Owing to an error on Parr's part, the type locality was stated by Cushman and Ozawa to be Danger Point, which is about 2 miles to the north-east, at the south end of the bathing beach, Torquay.

We have seven specimens of this variety from the type locality but have not met with it elsewhere.

Genus **Polymorphina** d'Orbigny, 1826.

POLYMORPHINA LINGULATA Stache.

(Plate XIV., Figs. 7a and c.)

- Polymorphina lingulata* Stache, 1864, p. 255, pl. xxiv., figs. 1a, b.
- P. pernaeformis* Stache, 1864, p. 256, pl. xxiv., figs. 2a, b.
- P. cognata* Stache, 1864, p. 257, pl. xxiv., figs. 3a, b.
- P. contorta* Stache, 1864, p. 257, pl. xxiv., figs. 4a, b.
- P. marsupium* Stache, 1864, p. 258, pl. xxiv., figs. 5a, b; Chapman, 1926, p. 67, pl. v., figs. 5a, b (after Stache).
- P. sacculus* Stache, 1864, p. 259, pl. xxiv., figs. 6a, b.
- P. gigantea* Stache, 1864, p. 262, pl. xxiv., figs. 9a, b.
- P. regularis* Münster, var. *lingulata* Stache: Chapman, 1926, p. 67, pl. v., figs. 1, 3, 4, 6 (after Stache).
- P. regularis* Münster, var. *pernaeformis* Stache: Chapman, 1926, p. 67, pl. v., fig. 2 (after Stache).
- P. regularis* Chapman (*non* Münster), 1926, p. 67, pl. v., figs. 9a, b.
- P. lingulata* Stache: Cushman and Ozawa, 1930, p. 120, pl. xxxi., figs. 7a, b (after Stache).

Stache described the species given in the above synonymy from the Tertiary of Whaingaroa Harbour, New Zealand. All of the original specimens of these, with the exception of *P. gigantea*, were examined in Vienna by Ozawa, who was satisfied that the difference among the species is not more than the range of variation of individuals of one species. *P. gigantea*, although not seen by Ozawa, is undoubtedly identical with *P. lingulata*, the only difference between Stache's figures of the two species being that *P. gigantea* is more rhomboid in section.

The thirteen examples now recorded as *P. lingulata* are all of the *P. gigantea* type, with the exception of one which is similar to Stache's figure of *P. contorta*. This species is apparently of very limited occurrence, as we have never been successful in finding it elsewhere than in the Oligocene (Hutchinsonian) of Gore, Southland, New Zealand. We have searched through a number of samples of material kindly sent by Professor J. A. Bartrum from Whaingaroa (now known as Raglan) and beds, also in the Whaingaroa Series, at Motutara Point, Kawhia Harbour, but did not meet with any examples of the genus *Polymorphina*.

POLYMORPHINA HOWCHINI Cushman and Ozawa.

(Plate XIV., Fig. 8.)

Polymorphina compressa Brady (*pars*) (*non P. compressa* d'Orb.), 1884, pl. lxxii., figs. 9, 10.

P. howchini Cushman and Ozawa, 1930, p. 121, pl. xxxi., figs. 9a, b.

The figured specimen, from the Post-Tertiary of Vic. Geol. Survey bore, No. 5, Parish of Wannaeue, Boneo, near Rosebud, 177-187 feet, is a very well preserved one, measuring 1.70 mm. in length, and with the costae better developed than usual. Frequently the wall is almost smooth.

Cushman and Ozawa described this species from the Lower Pliocene of McDonald's, Muddy Creek, Hamilton, Victoria. We have a number of examples from the type sample. The species also occurs as a living form in Bass Strait. The two specimens figured by Brady (*loc. cit.*) on Plate LXXII. (Figs. 9, 10) of the *Challenger* Report as *P. compressa* d'Orb., from off East Moncoeur Island, Bass Strait, 38-40 fathoms, are considered by the writers to be *P. howchini*.

Localities.

L. Pliocene.—McDonald's, Muddy Creek, Victoria.

Post-Tertiary.—Vic. Geol. Survey bore, No. 5, Parish of Wannaeue, 177-187 feet.

Recent.—Victoria: Shore sand, Anderson's Inlet and Barwon Heads.

POLYMORPHINA MYRAE, sp. nov.

(Plate XV., Figs. 4a-c.)

Test much compressed, fusiform in outline, both ends rounded; chambers compressed, elongated, arranged at first in an anti-clockwise sigmoid series, then biserially; sutures depressed, distinct; wall fairly thick, covered with fine longitudinal costae; aperture radiate.

Length of holotype, 2.85 mm.; breadth, 0.90 mm.; thickness, 0.30 mm.

Holotype (Parr Coll.) from Lower Pliocene, Beaumaris, Victoria, collected by W. J. Parr.

This very beautiful species attains a length of over 4 mm. and is therefore one of the largest known. It cannot be mistaken for any previously known form.

The only examples of *P. myrae* are from the type locality, at which it is not uncommon.

Genus **Sigmomorphina** Cushman and Ozawa, 1928.

SIGMOMORPHINA WYNYARDENSIS, sp. nov.

(Plate XV., Figs. 3a-c.)

Test compressed, lanceolate, greatest breadth in the upper half, tapering towards the base, margin subacute; chambers elongated and inflated, but variable in this respect, arranged in an open clockwise sigmoid series, each succeeding chamber much further removed from the base; sutures distinct, depressed, almost straight; wall smooth; aperture radiate.

Length of holotype, 2.14 mm.; breadth, 0.80 mm.; thickness, 0.45 mm.

Holotype (Parr Coll.) from Lower Miocene, *Crassatella* bed, Table Cape, Wynyard, Tasmania, collected by W. G. Parr.

This species resembles *S. nysti* (Reuss), described from the Crag of Antwerp, Belgium, but may be distinguished from that species by its much greater size, its inflated chambers, the inflation giving a lobulate margin to the test in side view, and the larger and more distinct chambers in the earlier half of the test.

S. wynyardensis is not known to occur elsewhere than at the type locality, where it is common.

SIGMOMORPHINA HAEUSLERI, sp. nov.

(Plate XV., Figs. 1a-c.)

Test ovate, compressed, margin acute; chambers elongated, of even width, arranged in a clockwise sigmoid series, each succeeding chamber removed farther from the base; sutures distinct, very slightly depressed; wall smooth, thick; aperture radiate.

Length of holotype, 1.68 mm.; breadth, 1.23 mm.; thickness, 0.63 mm.

Holotype (Auckland Museum Coll.) from Upper Eocene (Whaingaroa Series), Motutara, Kawhia Harbour, New Zealand, from collection of the late Dr. Rudolf Haeusler.

This species resembles in outline *Polymorphina marsupium* Stache, which was described from beds of the same age at Whaingaroa, but the chambers are arranged in a sigmoid series throughout. Had it not been that Ozawa had examined the type specimen of *P. marsupium* and found it to be a true *Polymorphina*, the writers would have identified the present form with Stache's species, because of the frequency with which this Sigmomorphine type of shell occurs in the Whaingaroa Series.

Localities.

Eocene.—New Zealand: Motutara Point, Kawhia Harbour.

Oligocene.—New Zealand: Gore, Southland.

Miocene.—Victoria: Point Danger, Torquay; Rocky Point, north end of Bell's Beach, Torquay; Vic. Geol. Survey bore, Hamilton, 80-85 feet; Filter Quarry, Batesford; railway cutting, Neumerella. Tasmania: Table Cape.

SIGMOMORPHINA CHAPMANI (Heron-Allen and Earland).

(Plate XV., Figs. 2a-c.)

Polymorphina chapmani Heron-Allen and Earland, 1924, p. 163, pl. x., figs. 60-63.

Sigmomorphina chapmani (H.-A. & E.): Cushman and Ozawa, 1930, p. 124, pl. xxxii., figs. 4, 5 (after Heron-Allen and Earland.)

This species was described by Heron-Allen and Earland from the Lower Miocene of the Filter Quarry, Batesford, Victoria. Our figured specimen, an immature one from the same locality, was the only one available when the plate was drawn, but we have since collected many fine examples from the marl overlying the limestone in the Filter Quarry and have other typical specimens from borings in Gippsland. *S. chapmani* is, as far as at present known, confined to the lower portion of the Miocene in Victoria.

Localities.

Miocene.—Victoria: Filter Quarry, Batesford; Lake Wellington bore, 1,130-1,138 feet; Vic. Geol. Survey bore, Parish of Moormurung, 716 feet; Mines Department bore, Parish of Nuntin, 1,453 feet; shell lime pit, east of Longford.

SIGMOMORPHINA BATESFORDENSIS, sp. nov.

(Plate XV., Figs. 6a-c.)

Test compressed, ovate, both ends subacute, margins rounded; chambers elongate, slightly inflated, arranged in an anti-clockwise sigmoid series, each succeeding chamber further removed from

the base; sutures slightly depressed, distinct; wall smooth, fairly thin; aperture radiate.

Length of holotype, 0.83 mm.; breadth, 0.50 mm.; thickness, 0.28 mm.

Holotype (Parr Coll.) from Lower Miocene, marl above limestone, Filter Quarry, Batesford, Victoria, collected by W. J. Parr.

This does not resemble closely any described species, the nearest being apparently *S. undulosa* (Terquem), in which the chambers are narrower as well as more embracing and numerous.

The figured specimen is megalospheric; the microspheric form is of similar dimensions but there are more chambers in the first half of the test and they are arranged in a more sharply-twisted sigmoid series, the outer margins of which protrude as ridges on both faces of the test.

This species is apparently restricted to beds of about the same age as the Batesford limestone.

Localities.

Miocene.—Victoria: Filter Quarry, Batesford; lower beds, Muddy Creek; Vic. Geol. Survey borings, Hamilton, 80-85 feet, and Parish of Meerlieu, 1,200 feet; Robertson's Quarry, Longford; Castle Cove (upper beds); Alkemade's Quarry, Kawarren.

SIGMOMORPHINA WILLIAMSONI (Terquem).

(Plate XV., Fig. 5.)

Polymorphina lactea (Walker and Jacob), var. *oblonga* Williamson (non *P. oblonga* d'Orb.), 1858, p. 71, pl. vi., figs. 149, 149a.

P. williamsoni Terquem, 1878, p. 37.

Sigmomorphina williamsoni (Terq.): Cushman and Ozawa, 1930, p. 138, pl. xxxviii., figs. 3, 4. Parr, 1932, p. 12, pl. i, fig. 20.

This species was described from shallow water off the British Isles and has been recorded by Sidebottom (as *Dimorphina milletti*) from off the coast of New South Wales and by the writer from shallow water at Black Rock and Williamstown, Victoria

Localities.

Recent.—Victoria: Black Rock; Williamstown. Tasmania: Devonport. New Zealand: Off the Snares, 60 fathoms.

Genus **Sigmoidella** Cushman and Ozawa, 1928.

SIGMOIDELLA ELEGANTISSIMA (Parker and Jones).

(Plate XIV., Fig. 9.)

Polymorphina elegantissima Parker and Jones, 1865, p. 438; Brady, Parker, and Jones, 1870, p. 231, pl. xl., figs. 15*b*, *c* (*non a*). Chapman, 1909, p. 132, pl. x., fig. 3.

Sigmoidella elegantissima (P. & J.): Cushman and Ozawa, 1929, p. 76, pl. xvi., figs. 10, 11; 1930, p. 140, pl. xxxix., figs. 1*a-c*.

Typical examples of this species are common. This is perhaps the most distinctive species of the Polymorphinidae found in Recent Australian seas. It is noteworthy that it has not occurred in any of the Recent material we have examined from around New Zealand, where its place appears to be taken by the species here described as *S. novozealandica*. Although Cushman and Ozawa had material from a number of localities in the New Zealand area, their only record of *S. elegantissima* from that region was from Dusky Sound. We have, however, small, but what appear to be otherwise typical, examples of *S. elegantissima* and *S. kagaensis*, which also does not seem to occur living off New Zealand, from the Oligocene (Hutchinsonian) of Clifden, Southland, New Zealand.

Localities.

Oligocene.—New Zealand: Clifden, Southland (Horizon 6*c*).

Miocene.—Victoria: Point Danger, Torquay; The Ledge, Bird Rock Cliffs, Torquay; Rocky Point, north end of Bell's Beach, Torquay; Filter Quarry, Batesford; Vic. Geol. Survey bores, Hamilton, 80-85 feet, and Parish of Moormurung, 716 feet; Waurin Ponds; Skinner's, Mitchell River, Bairnsdale; Robertson's Quarry, Longford; Pound Creek Reserve, Bairnsdale; railway cutting, Neumerella; Western Beach, Geelong; Balcombe Bay, Mornington; cliffs just west of mouth of Curdie's Inlet. Western Australia: Cape Range.

Pliocene.—Victoria: Beaumaris; Forsyth's, Grange Burn, Hamilton.

Post-Tertiary.—Victoria: Vic. Geol. Survey bore No. 5, Parish of Wannaeue, Boneo, near Rosebud, 177-187 feet.

Recent.—Victoria: Cowes; San Remo; Barwon Heads. Tasmania: Oyster Bay; east of Cape Pillar, 100 fathoms. New South Wales: 12½ miles east of Cape Byron, 111 fathoms; Watson's Bay, Port Jackson. Queensland: Off Masthead Island, 20 fathoms. Western Australia: Geraldton Harbour; *Bonthorpe* sounding, Great Australian Bight, lat. 33° 15' S., long. 126° 10' E., 70 fathoms.

SIGMOIDELLA KAGAENSIS Cushman and Ozawa.

(Plate XIV., Fig. 10.)

Polymorphina elegantissima Brady, Parker, and Jones, 1870 (*pars*), p. 231, pl. xl., fig. 15a.

Sigmoidella kagaensis Cushman and Ozawa, 1928, p. 19, pl. ii., fig. 14; 1929, p. 76, pl. xiii., fig. 15; pl. xvi., fig. 9; 1930, p. 141, pl. xxxix., figs. 2, 5.

Cushman and Ozawa note the close relationship of this species to *S. elegantissima* and state that it probably represents a cool water relative of that species. This is, however, not the case, as we have typical examples of both species occurring together in warm water off Masthead Island, Queensland, and specimens of *S. kagaensis* from *Challenger* Station 185, off Raine Island, 155 fathoms.

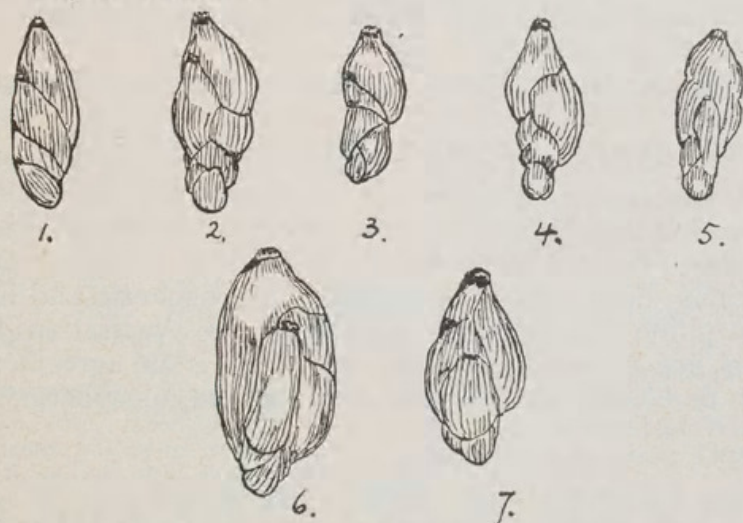
Localities.

Oligocene.—New Zealand: Clifden, Southland (Horizon 6c).

Miocene.—Victoria: Point Danger, Torquay; The Ledge, Bird Rock Cliffs, Torquay; Rocky Point, north end of Bell's Beach, Torquay; Filter Quarry, Batesford; Vic. Geol. Survey bore, Hamilton, 80-85 feet; Castle Cove (upper beds); Robertson's Quarry, Longford; railway cutting, Neumerella; cliffs just west of mouth of Curdie's Inlet.

Pliocene.—Victoria: Beaumaris; Forsyth's, Grange Burn, Hamilton; McDonald's, Muddy Creek, Hamilton.

Recent.—Tasmania: East of Cape Pillar, 100 fathoms. New South Wales: 12½ miles east of Cape Byron, 111 fathoms. Queensland: Off Masthead Island, 20 fathoms; *Challenger* Station 185; off Raine Island, 155 fathoms. Western Australia: *Bonthorpe* sounding, Great Australian Bight, lat. 33° 50' S., long. 125° 17' E., 40 fathoms.



Text-figs. 1-7.—*Guttulina regina* (B., P. & J.). Shore sand, Barwon Heads, Vic. 1 and 3. *Polymorphinella*-like specimens. 2, 4. Specimens resembling *Pseudopolymorphina*. 5, 6. Other abnormal specimens. 7. Typical form of the species. All $\times 18$.

SIGMOIDELLA NOVOZEALANDICA, sp. nov.

(Plate XV., Figs. 8a-c.)

Test compressed, sub-triangular in side view, margins sub-acute; chambers elongate, overlapping, arranged in a clockwise sigmoid series and slowly increasing in width; sutures distinct, not depressed; wall smooth, translucent; aperture radiate.

Length of holotype, 1.25 mm.; breadth, 0.90 mm.; thickness, 0.50 mm.

Holotype (Auckland Museum Coll.) from dredgings, north-east of Auckland Island, south of New Zealand, 95 fathoms.

This species occurs abundantly in dredgings from around the Subantarctic Islands of New Zealand and also off the South Island of New Zealand. The most closely related species is probably *S. elegantissima*, in which the chambers are curved and more embracing at the base, and the margin is angulate.

Localities.

Recent.—New Zealand: Off Puysegur Point, 100 fathoms; 60 miles east of Lyttelton, 100 fathoms; 14 miles north-east of Auckland Island, 95 fathoms; 10 miles north of Enderby Island, 85 fathoms; off the Snares, 50 fathoms.

Genus **Glandulina** d'Orbigny, 1826.

GLANDULINA LAEVIGATA (d'Orbigny).

(Plate XIII., Figs. 6a and c.)

Nodosaria (Glandulina) laevigata d'Orbigny, 1826, p. 252, No. 1, pl. x., figs. 1-3; Chapman and Parr, 1926, p. 378, pl. xvii., fig. 20.

Polymorphina glandulinoides Fornasini: Chapman and Parr, 1926, p. 392., pl. xxi., fig. 76.

Glandulina laevigata (d'Orb.): Cushman and Ozawa, 1930, p. 143, pl. xl., figs. 1a, b.

Cushman and Ozawa state that this species is derived from *Pyrulina* and that examples of it from two of d'Orbigny's localities, viz., the Tertiary of the environs of Siena, Italy, and the Miocene of the Vienna Basin, have shown this relationship. The specimen here figured is evidently microspheric and indicates a polymorphine relationship. As a rule, the Australian Tertiary specimens are uniserial throughout. This is in agreement with Cushman and Ozawa's description of the megalospheric form.

Localities.

Miocene.—Victoria: Sea floor, Apollo Bay; Point Danger. Torquay; The Ledge, Bird Rock Cliffs, Torquay; Filter Quarry, Batesford; Vic. Geol. Survey borings, Hamilton, 80-85 feet, Parish of Meerlieu, 1,200 feet, and Parish of Moormung, 716 feet; Castle Cove (upper beds); Robertson's Quarry, Longford;

Wauru Ponds; Orphanage Hill, Geelong; Western Beach, Geelong; Balcombe Bay; Grice's Creek; Kackeraboite Creek; Altona Bay coal shaft; west side of mouth of Curdie's Inlet; Beaumaris (lower beds). Tasmania: Table Cape.

Pliocene.—Victoria: Jemmy's Point, Lake Entrance.

Recent.—Tasmania: Oyster Bay.

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Explanation of Plates.

(a, b, side views; c, basal view, except Plate XIV., fig. 4c, which is apertural view.)

PLATE XII.

- Fig. 1.—*Guttulina problema* d'Orb. Oligocene (Hutchinsonian), Otiake, South Island, N.Z. $\times 20$.
 Fig. 2.—*G. irregularis* (d'Orb.). Oligocene (Hutchinsonian), Horizon 6a, Clifden, Southland, N.Z. $\times 25$.
 Fig. 3.—*G. yabei* Cushman and Ozawa. Oligocene (Hutchinsonian), Otiake, N.Z. $\times 20$.
 Fig. 4a-c.—*G. yabei* C. & O. Dredgings off the Snares, N.Z., 60 fms. $\times 40$.
 Fig. 5.—*G. regina* (Brady, Parker, and Jones). Shallow water, Port Jackson, N.S.W. $\times 25$.
 Fig. 6.—*G. regina*, var. *crassicostata* Cushman and Ozawa. Lower Pliocene, Beaumaris, Vic. $\times 25$.
 Fig. 7a-c.—*G. regina*, var. *chapplei*, var. nov. Holotype of variety. Lower Miocene, Fisher's Point, W. of Cape Otway, Vic. $\times 30$.
 Fig. 8.—*G. lactea* (Walker and Jacob). Dredgings off the Snares, N.Z., 60 fms. $\times 25$.
 Fig. 9a-c.—*G. costulata* (Cushman). Lower Pliocene, Beaumaris, Vic. a, b, $\times 30$; c, $\times 40$.
 Fig. 10a and c.—*G. seguenziana* (Brady). Dredgings 22 miles E. of Narra-been, N.S.W. $\times 25$.
 Fig. 11.—*G. silvestrii* Cushman and Ozawa. Lower Miocene, marl above limestone, Filter Quarry, Batesford, Vic. $\times 40$.
 Fig. 12.—*Globulina gibba* d'Orb. Lower Miocene, marl above limestone, Filter Quarry, Batesford, Vic. $\times 15$.
 Fig. 13.—*G. gibba*, var. *globosa* (v. Münster). Shore sand, Point Lonsdale. $\times 15$.

PLATE XIII.

- Fig. 1a-c.—*Guttulina* sp. Upper Cretaceous, Gingin, W.A. a, b, $\times 30$; c, $\times 40$.
 Fig. 2a-c.—*Pyrulina fusiformis* (Roemer). L. Miocene, The Ledge, Bird Rock Cliffs, Torquay, Vic. $\times 30$.
 Fig. 3a-c.—*P. fusiformis*. L. Miocene, marl above limestone, Filter Quarry, Batesford, Vic. $\times 35$.
 Fig. 4a-c.—*Guttulina yabei* C. & O. Slender form. Shallow water off Black Rock, Vic. $\times 25$.
 Fig. 5a-c.—*G. yamazakii* Cushman and Ozawa. Lower Pliocene, Beaumaris, Vic. a, b, $\times 30$; c, $\times 40$.
 Fig. 6a and c.—*Glandulina laevigata* (d'Orb.). Microspheric form. Miocene, Grice's Creek, Vic. $\times 30$.
 Fig. 7a-c.—*Pyrulina cylindroides* (Roemer). Prickly and fistulose specimen. Miocene, Grice's Creek, Vic. $\times 30$.

PLATE XIV.

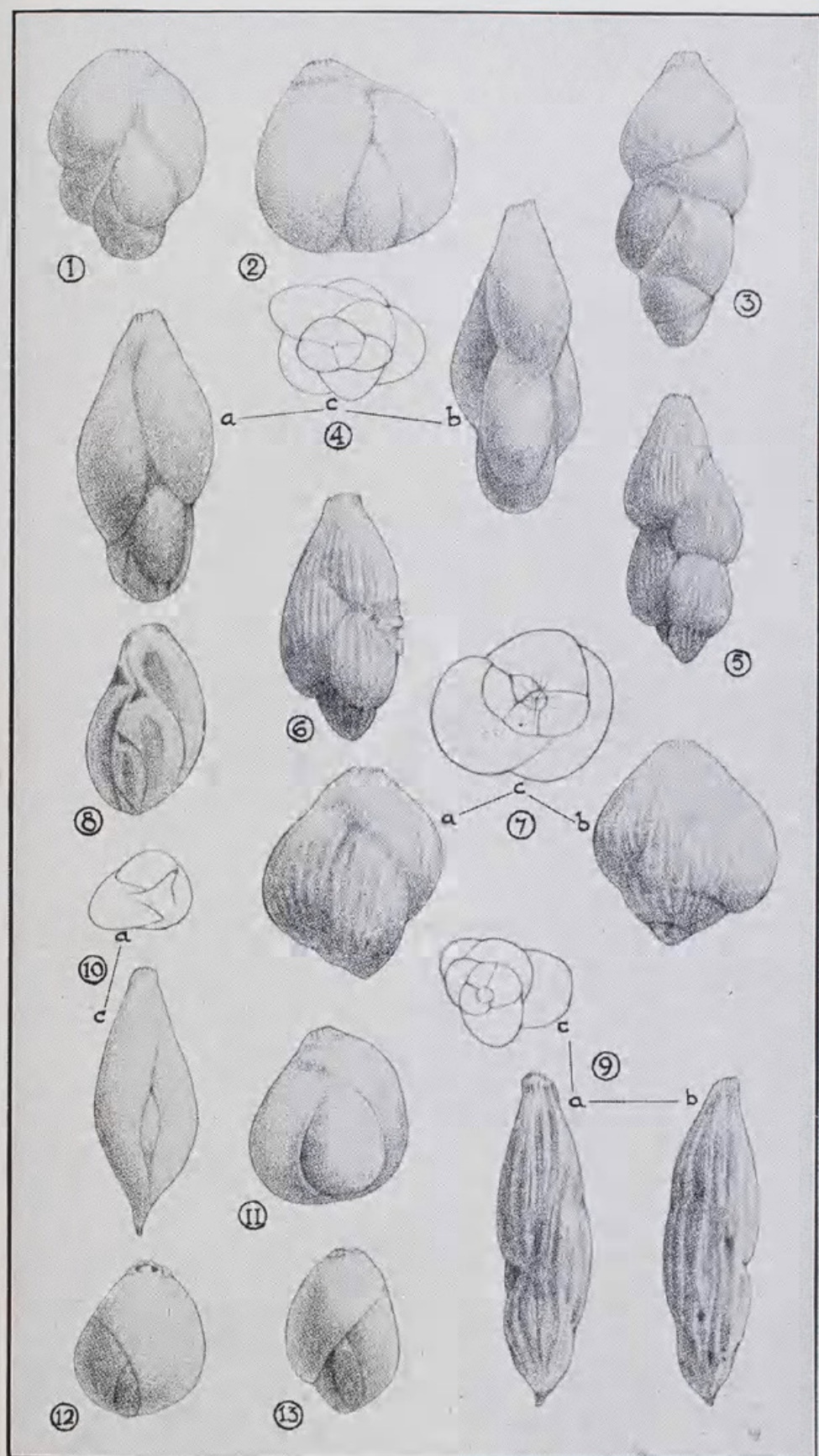
- Fig. 1a-c.—*Pyrulina crespinae*, sp. nov. Holotype. Lower Pliocene, Beaumaris, Vic. $\times 30$.
 Fig. 2a-c.—*Pseudopolymorphina doanei* (Galloway and Wissler). Lower Pliocene, Beaumaris, Vic. $\times 25$.
 Fig. 3.—*P. doanei*, var. *beaumarisensis*, var. nov. Holotype of variety. Lower Pliocene, Beaumaris, Vic. $\times 30$.
 Fig. 4a-c.—*P. rutila* (Cushman), var. *parri* Cushman and Ozawa. Lower Miocene, Rocky Point, Torquay. a, b, $\times 30$; c, $\times 40$.
 Fig. 5a-c.—*Pyrulina fusiformis* (Roemer). Example with uniserial chambers. Miocene, Grice's Creek, Vic. a, b, $\times 25$; c, $\times 35$.
 Fig. 6a-c.—*Pseudopolymorphina tasmanica*, sp. nov. Holotype. Lower Miocene, Table Cape, Tas. a, b, $\times 25$; c, $\times 30$.

- Fig. 7a-c.—*Polymorphina lingulata* Stache. Oligocene (Hutchinsonian), Chatton Sands, near Gore, South Island, N.Z. $\times 20$.
 Fig. 8.—*P. howchini* Cushman and Ozawa. Post-Tertiary, Vic. Geol. Survey bore No. 5, Parish of Wannaeue, near Rosebud, Vic., 177-187 ft. $\times 20$.
 Fig. 9.—*Sigmoidella elegantissima* (Parker and Jones). Lower Pliocene, Beaumaris, Vic. $\times 18$.
 Fig. 10.—*Sigmoidella kagaensis* Cushman and Ozawa. Lower Pliocene, Beaumaris, Vic. $\times 20$.

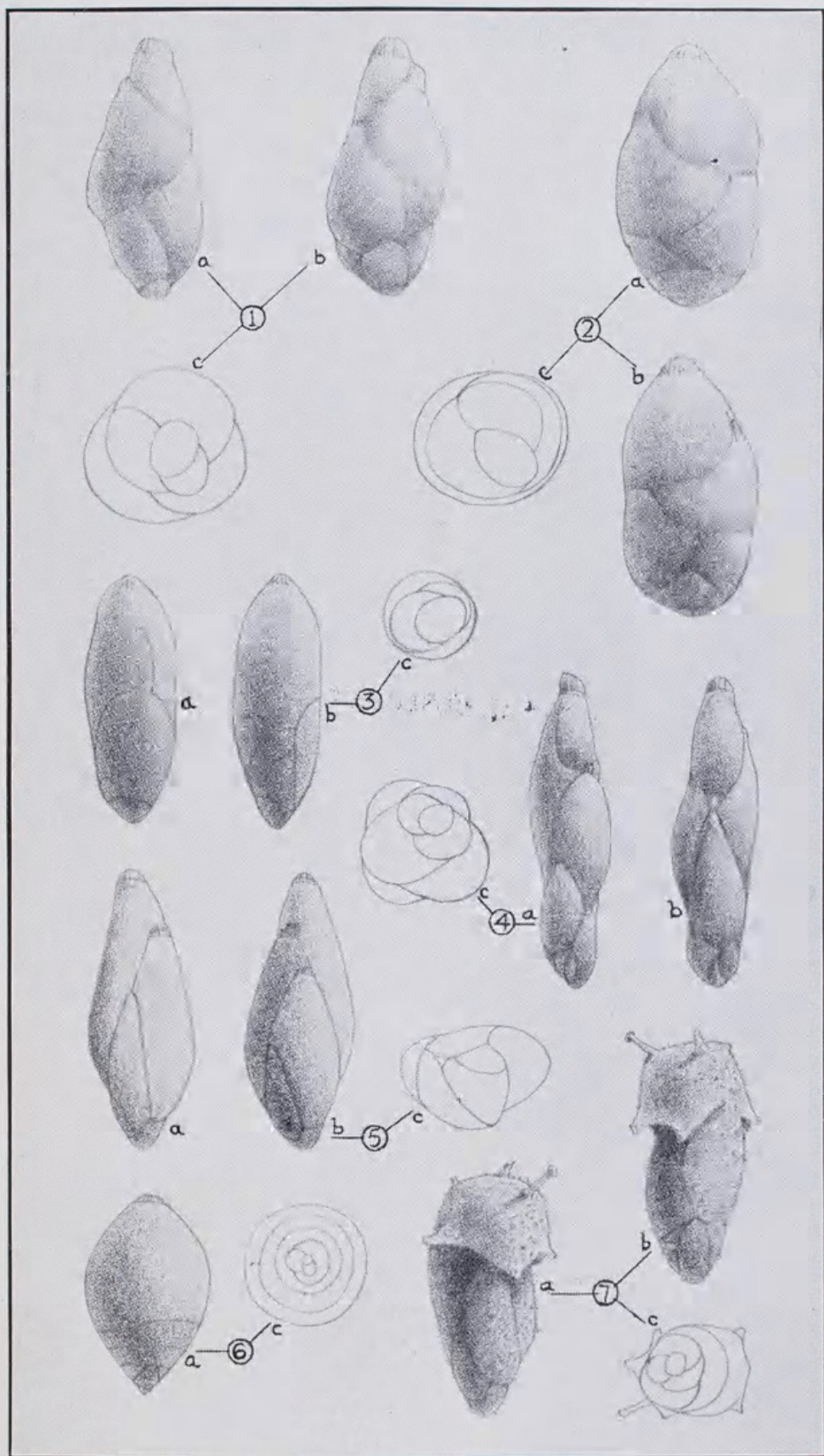
PLATE XV.

- Fig. 1a-c.—*Sigmomorphina haeusleri*, sp. nov. Holotype. Upper Eocene (Whaingaroa Series), Motutara Point, Kawhia Harbour, N.Z. $\times 20$.
 Fig. 2a-c.—*S. chapmani* (Heron-Allen and Earland). Lower Miocene, marl above limestone, Filter Quarry, Batesford, Vic. $\times 30$.
 Fig. 3a-c.—*S. wynyardensis*, sp. nov. Holotype. Lower Miocene, Table Cape, Tas. a, b, $\times 20$; c, $\times 25$.
 Fig. 4a-c.—*Polymorphina myrae*, sp. nov. Holotype. Lower Pliocene, Beaumaris, Vic. a, b, $\times 18$; c, $\times 25$.
 Fig. 5.—*Sigmomorphina williamsoni* (Terquem). Dredgings off the Snares, S. of New Zealand, 60 fms. $\times 40$.
 Fig. 6a-c.—*S. batesfordensis*, sp. nov. Holotype. Lower Miocene, marl above limestone, Batesford, Vic. $\times 40$.
 Fig. 7a-c.—*Guttulina clifdenensis*, sp. nov. Holotype. Oligocene (Hutchinsonian), Horizon 6a, Clifden, Southland, N.Z. $\times 25$.
 Fig. 8a-c.—*Sigmoidella novozealandica*, sp. nov. Holotype. Dredgings N.-E. of Auckland Island, S. of New Zealand, 95 fms. $\times 25$.
 Fig. 9a and c.—*Guttulina lactea*, var. *earlandi* Cushman and Ozawa. Lower Miocene, Muddy Creek, Vic. $\times 80$.

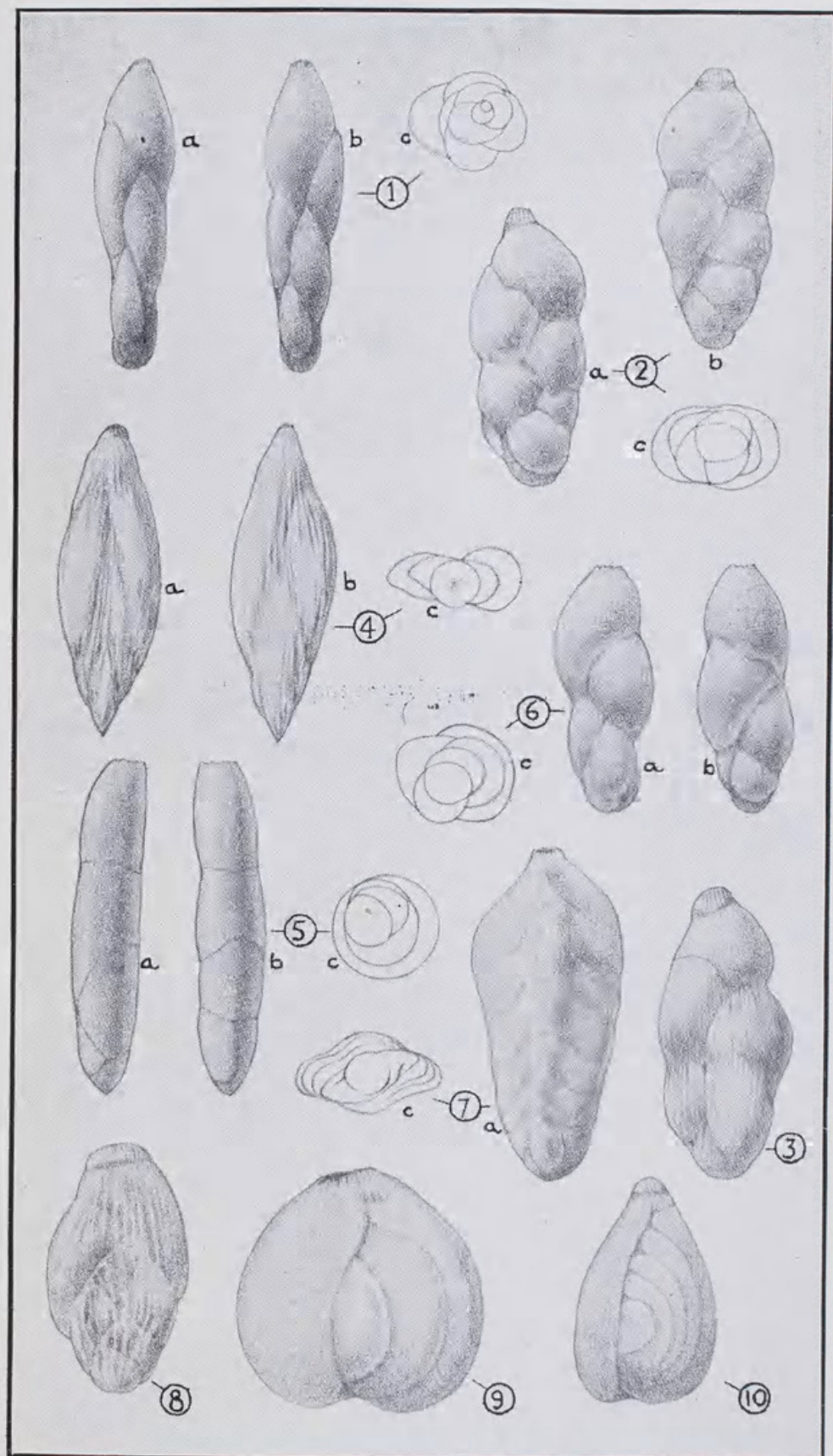
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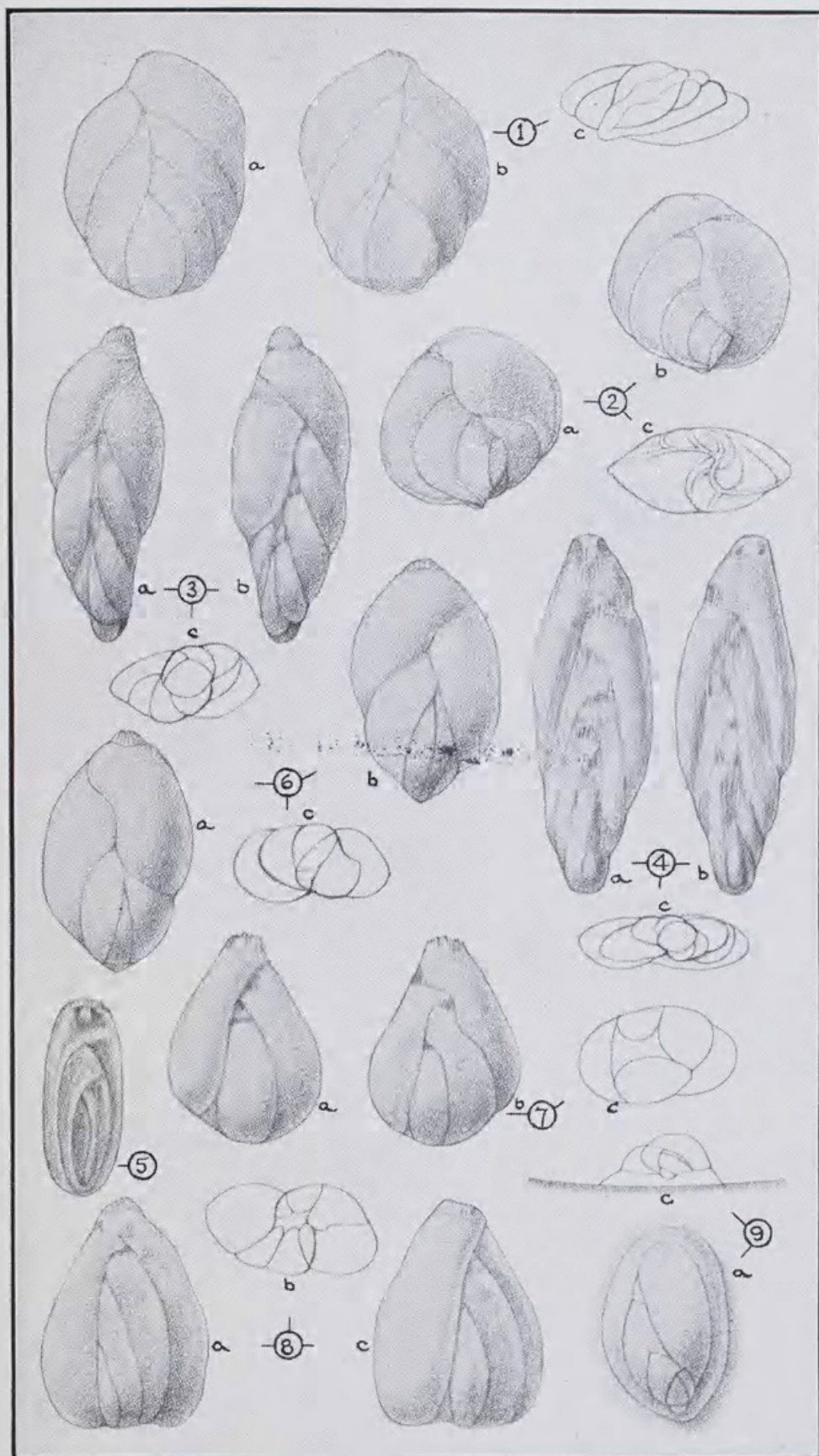
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