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HOLOCENE FORAMINIFERIDA FROM THE FITZROY RIVER ESTUARY, NORTH WEST AUSTRALIA

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Abstract

Six species are recorded or described. One of these *Siphotrochammina* aff. *lobata* does not appear to have been previously recorded from Australian waters, another *Nubeculopsis queenslandica* is discussed in terms of its validity as a species and genus, and the remaining four are described as new. Of these, three have morphological features which appear to justify the erection of new genera. They are *Munkiella* (*M. lingulata*), *Bisaccoides* (*B. cuspidatus*) and *Delosinella* (*D. planispiralis*). Specimens were obtained from a shallow borehole in a mangrove flat, and there is no evidence of their existence in the local living fauna, though this appears probable.

Material

The foraminiferida described herein derive from a shallow core (maximum depth 280 cm) taken in the course of geomorphological investigations by Dr J. N. Jennings of the Research School of Pacific Studies, Australian National University. The samples listed were, amongst others, entrusted to the author some years ago for examination of their fossil content for any light it might throw on the matter of marine transgression in the area. However, apart from this core (site distinguished as Munkayarra H. 12), only very sparse assemblages of foraminiferids were found, up to a maximum of 17 specimens per sample, and in most cases less or nil.

The location of the core was at grid reference 189003 on 1:50000 R.A.S.C. sheet 3663-III, Derby, Lat. 17°28′ S., Long. 123°35′ E. It was drilled in low mangrove scrub (*Avicennia marina*), but the area is one of extremely fast lateral erosion by the main estuarine currents, and it is probable that the sediments concerned have long since been removed in this manner (Jennings, *pers. comm.*)

Four samples were taken from the core, as described hereunder:

275-280 cm. Silt with a few small clay lumps. Residue after washing through a 180-mesh sieve was almost entirely marine skeletal material, including pteropod and other molluscan shells, ostracods, sponge spicules in profusion, alcyonarian spicules and foraminiferids, with mica flakes and a few small angular sand-grains. Approximately 150 species of foraminiferids were found, mostly smaller benthic species with a few pelagic forms and the juvenile tests or small fragments of the commoner larger species. The general even size of specimens suggests that the assemblage is a current-sorted thanatocoenosis having little relation to the living local population at the time of deposition.

195-200 cm. Generally similar to the above, but with a more diverse foraminiferid assemblage of ca. 200 species.

85-90 cm. Similar to the foregoing samples but containing a proportion of woody fibre and having a smaller assemblage of ca. 110 species.

0-5 cm. Quite different to the deeper samples, containing much fibrous material and a small assemblage (ca. 20 species) of foraminiferids, dominated by the agglutinated genera *Trochammina* and *Siphotrochammina*. Small hollow agglutinated tests with a pink shining chitinoid lining were also present, and in the lack of expert opinion were provisionally considered to be Thecamoebidae.

Very little can be deduced from these widely-spaced samples, other than an increasing freshwater influence in the later stages of deposition. The Fitzroy estuary alternates between a short phase when fresh water dominates and a long phase when salinities are very high and marine influence dominates. (Jennings, *pers. comm.*). Reworking is probably common, as noted earlier. The assem-

blages found consist in the main of well-known Indo-Pacific shallow-water species, and the interest of the samples lies in the occurrence of comparatively few forms which are either undescribed or of interest in terms of distribution or morphology. These are dealt with in the following systematic account. It is unfortunate that the remoteness of the locality has precluded further collection and preservation of fresh bottom samples, so that the presence of these species in the living state cannot as yet be established.

Systematic Account

Family TROCHAMMINIDAE Schwager 1877
Genus **Siphotrochammina** Saunders 1957

Type species: Siphotrochammina lobata Saunders 1957, Holocene, Trinidad, West Indies.

Siphotrochammina aff. lobata Saunders, 1957
(Plate 2, fig. 1)

This species is noted because the genus does not appear to have hitherto been recorded from Australia. It was described from brackish-water deposits in the West Indies and apparently has similar habitat preferences locally. It occurs in numbers only in the 0-5 cm sample which shows freshwater influence in the sharp reduction in foraminiferid species and by the presence, as noted above, of an organism which may be a thecamoebid and which occurred in other bore samples showing little or no marine influence.

Though direct comparison with the type was not practicable, specimens closely resembled that figured by Saunders, having the siphon-like umbilical extension of the chamber and the distally-facing aperture, also the tendency to irregularity in the chamber shape. Coiling direction is random, about half the specimens being either right- or left-handed.

The occurrence of this brackish-water species in such widely-separated localities is not easily explained, as it is apparently restricted to the Holocene. It may be a case of convergent evolution from some cosmopolitan species in the particular environment of tropical brackish water. However, the morphological similarity of the present form to *S. lobata* requires it to be recorded as close to or identical with that species.

Family NUBECULARIIDAE Jones 1875
Sub-family NUBECULARIINAE Jones 1875
Genus **Nubeculopsis** Collins 1958

Type species: Nubeculopsis queenslandica Collins 1958, Holocene, Great Barrier Reef.

Nubeculopsis queenslandica Collins 1958

This species was described from the Great Barrier Reef and was distinguished from *Nubecularia* by the loss of the cornuspirine coil which follows the proloculus in that genus. Arnold (1967) has described the high degree of variation encountered in artificially cultured progeny of *Nubecularia lucifuga* Defrance and has expressed the opinion (*pers. comm.*) that *Nubeculopsis* falls within the range of variation of both natural and cultured populations of *N. lucifuga* from the Mediterranean.

Nubeculopsis occurs in the present material, and specimens are similar to those from the Queensland coast. While they are very variable in form, depending largely on the surface to which they were attached, they are consistent with the characteristics of the genus as described. No specimens referable to *N. lucifuga* were found, nor was this species recorded in the work in which *Nubeculopsis* was erected.

The writer has never found specimens referable to *Nubeculopsis* in the cool water deposits of the southern coast of Australia, where *N. lucifuga* is common and typical. Recent literature on foraminiferida of the central New South Wales coast (Alberti 1968a, 1968b, 1970, 1978) does not mention either genus, and Dr Alberti has informed me that he has not as yet found either form in N.S.W. waters. It may be that intermediate forms exist on the western coast of Australia, but until such evidence is found it is a reasonable assumption that the geographical ranges of the two taxa are mutually exclusive, at least in the Australian context.

It may be arguable whether the loss of the coiled part of the juvenile development justifies the erection of a separate genus, though this has been accepted at even higher taxonomic levels in other families, e.g. *Textularia* and *Spiroplectammina*. However, until Australian natural populations are found to exhibit the high

degree of plasticity of form reported by Arnold, it would seem advisable to retain the present taxonomic distinctions.

Family ELPHIDIIDAE Galloway 1937
Sub-family ELPHIDIINAE Galloway 1937
Genus **Munkiella** gen nov.

Type species: Munkiella lingulata sp. nov.

Diagnosis: Test planispiral, semi-involute, chamber structure rotaliid with doubled septa and interseptal canals connected to a spiral canal between chamber base and the periphery of the previous whorl. A single row of pores follows the proximal edge of the sutures, generally masked by weakly-developed septal bridges with intervening cusps leading to pores. No external aperture; a primary areal foramen in the septal face of the last chamber is masked by a lingulate process arising from the periphery of the earlier whorl, passing up the face of the chamber and joining it in a depressed suture lined with irregular pores to form a chamberlet which communicates with the last chamber through the foramen and with the spiral canal below the chamber base. The chamberlet is resorbed in the construction of a new chamber and replaced by a rotaliid doubled septum. Wall hyaline-radiate, finely perforate.

The systematic position of this genus is somewhat doubtful. Its radial wall-structure, rotaliid chamber-form, sutural pores and rudimentary septal bridges suggest placement in the Elphidiinae, but the possession of an apertural chamberlet is a feature apparently not recorded for this sub-family. However, it could have evolved from a form such as *Cribroelphidium* by the development of a more complex apertural structure, and it is therefore placed tentatively in the Elphidiinae.

Munkiella lingulata sp. nov.
(Plate 1, figs. 1a, 1b, 1c. Plate 2, figs. 2a, 2b.

Description: Test planispiral with a tendency toward trochospiral growth shown by a slight obliquity of the final whorl in some specimens. Chambers rapidly increasing in height, 7 to 9 in the last whorl, periphery rounded and lobulate with a varying degree of angularity in the outline of later chambers. Sutures slightly depressed in the centre of the test, deepening to a cleft toward the periphery and then flattening out. A row of larger pores follows the proximal side of the suture, masked in larger specimens by an extension of the following chamber wall, forming weakly-developed septal bridges with intervening cusps leading to the pores, or obscured by their placement in the cleft formed by an inrolling of the edge of the previous chamber.

No external aperture is present, a primary areal foramen being masked by a lingulate process forming a chamberlet, arising from the periphery of the previous whorl, passing up the face and joined thereto in a depressed suture with no discernible apertural slit but lined with a row of irregular pores.

Chamber structure is rotaliid. During the formation of a new chamber the previous lingulate chamberlet is resorbed and replaced by a septal flap forming a double septum with interseptal canal to which pores apparently lead (though this was not clearly established by observation). The chamber base is saddle-shaped, arching clear of the previous whorl to form a spiral canal and curving upward to form the distal face, in which an arch-shaped areal foramen connects the chamber lumen with that of the apertural chamberlet, which in turn connects directly with the spiral canal and through this with interseptal canals (see text-figure 1). Chamber sides are produced toward the centre of the test to partly cover the earlier whorl, resulting in a nearly involute test.

Wall structure is hyaline-radial, finely perforate and semi-translucent, including the wall of the apertural chamberlet, which is therefore a true chamberlet and not a tooth-plate structure. Holotype from bore Munkayarra H. 12, 85-90 cm. Also found at 195-200 and 275-280 cm.

Dimensions of holotype: major diameter 0.54 mm, minor diameter 0.35 mm, thickness 0.18 mm.

Deposition of holotype: National Museum of Victoria, reg. no. P159780.

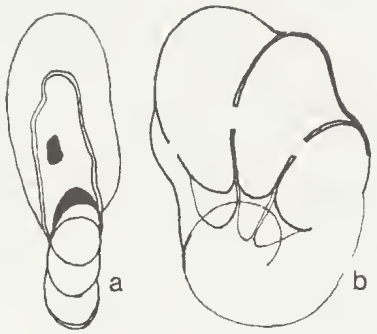

Fig. 1. *Munkiella lingulata* sp. nov.
(a) edge view with lingulate process removed, showing septal foramen.
(b) diagrammatic axial section.

Family CIBICIDIDAE Cushman 1927
Sub-family PLANULININAE Bermudez 1952
Genus **Bisaccioides** gen nov.

Type species: Bisaccioides cuspatus sp. nov.

Diagnosis: Test irregularly planispiral, umbilicus on both sides covered by a perforate and pustulose plate which extends as an inflated band over the depressed sutures from one side to the other, forming a continuous sutural canal which opens to the exterior by a series of cuspate arched openings on both sides of the sutural band. A similar but wider band covers the junction of the terminal chamber with the previous whorl, forming an apertural chamberlet masking a large basal aperture.

This genus has a morphological similarity to *Bisaccium* Andersen 1951 in possessing covered sutural spaces with accessory apertures, and in particular by having an extension covering the junction between the terminal chamber and the previous whorl so as to mask the aperture. However, *Bisaccium* is described as having a thin and finely perforate test wall, and by its classification in the Nonionidae is presumably granular in wall structure. The wall in *Bisaccioides* is comparatively thick, coarsely perforate, bilamellar and radial in structure, suggesting that its place is in the Cibicididae and because of its planispiral and non-adherent character, in the sub-family Planulininae.

Bisaccioides cuspatus sp. nov.
(Plate 1, figs. 2a, 2b, 2c. Plate 2, figs. 3a, 3b.)

Description: Test irregularly planispiral, chambers somewhat globose, up to 6 in the last whorl, periphery rounded and lobulate, biumbilicate. The umbilicus on both sides is covered by a perforate and pustulose plate which extends as an inflated band from one side to the other, covering the depressed sutures and forming a continuous sutural canal which opens to the exterior by a row of cuspate and arched openings on both sides of the band. A similar but wider band covers the junction of the terminal chamber with the periphery of the previous whorl, forming an apertural chamberlet which connects the enclosed umbilical space with the final chamber by a large arched basal aperture, and opens to the exterior by a similar double row of arched openings. When a new chamber is added, the part of the band within the chamber is resorbed, leaving the arched aperture as a septal foramen. Test wall is bilamellar, radial and coarsely perforate. Holotype from bore Munkayarra H. 12, 85-90 cm. Common at this sample, rare at 195-200 and 275-280 cm.

Dimensions of holotype: major diameter 0.5 mm, minor diameter 0.35 mm, thickness 0.21 mm.

Deposition of holotype: National Museum of Victoria, reg. no. P159781.

Family DELOSINIDAE Parr 1950 (emend.)

Diagnosis: Test triserial or planispiral, no primary aperture but large sutural pores open into subsutural canal.

Genus **Delosinella** gen. nov.

Type species: Delosinella planispiralis sp. nov.

Diagnosis: A delosinid in all respects except for the growth mode, which is planispiral rather than triserial.

Delosinella planispiralis sp. nov.
(Plate 1, figs. 3a, 3b. Plate 2, fig. 4.)

Description: Test ovate, chambers arranged in a planispiral coil and rapidly increasing in height, sutures slightly depressed and flanked on both sides by a row of large pores leading to

a subsutural canal, no primary aperture. Wall hyaline, translucent and finely pored. Holotype from bore Munkayarra H. 12, depth 195-200 cm. Only seven specimens were found, all consistent in form and differing only in size.

Dimensions of holotype: length 0.36 mm, width 0.22 mm, thickness 0.16 mm.

Deposition of holotype: National Museum of Victoria, reg no. P159782.

This species differs from the presently accepted definition of *Delosina* in having a planispiral growth mode rather than triserial, a difference which in the Nodosariacea is recognised at family level. However, in view of the small number of species involved, it appears more practical to erect a new genus within the family Delosinidae and to amend the family diagnosis to include planispiral forms.

Another delosinid occurred in rather greater numbers in the same material. These specimens were of triserial growth mode and had a row of pores along the sutures, more distinct in the small specimens than in the larger, together with a coarsely-pored area at the distal end. They appear to be referable to *D. polymorphinoides* Earland.

Family NONIONIDAE Schultze 1854
Sub-family NONIONINAE Schultze 1854
Genus **Nonionella** Cushman 1926

Type species: Nonionella miocenica Cushman 1926, Miocene, U.S.A.

Nonionella excavata sp. nov.
(Plate 1, figs. 4a, 4b, 4c. Plate 2, fig. 5.)

Diagnosis: A *Nonionella* with an excavated umbilicus partially infilled with spike-like processes.

Description: Test trochospiral, umbilicate, somewhat compressed with later chambers inflated, periphery rounded and slightly lobulate. All chambers visible on spiral side, only the last whorl of up to 10 chambers visible on umbilical side. Sutures slightly depressed and recurved, limbate on early chambers. On the umbilical side sutures end in a small radial fissure, and the inner end of each chamber is infolded radially for a short distance and attached to the floor of the chamber to form a division. The proximal part thus divided forms a lobate termination, the distal part forms an umbilical flap masking the narrow slit-like aperture and develops pointed protuberances which project into the umbilical cavity, those of earlier chambers appearing as clear granular nodules filling the centre of the umbilicus. The septal foramen is elliptical with a slight lip, near the base of the penultimate chamber. Wall structure is hyaline-granular, translucent and finely pored. Holotype from bore Munkayarra H. 12, depth 195-200 cm.

Dimensions of holotype: major diameter 0.63 mm, minor diameter 0.38 mm, thickness 0.21 mm.

Deposition of holotype: National Museum of Victoria, reg no. P159783.

Eleven specimens were found, nine coiled to the left when viewed from the umbilical side, two coiled to the right. One additional left-coiled specimen was found in beach sand from Doctor's Creek in the same general locality, suggesting its possible presence in the living state.

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Explanation of Plates

PLATE 1 (drawings)

Fig. 1. *Munkiella lingulata* sp. nov. Holotype. (a) and (b) side views, (c) apertural view. P159780.

Fig. 2. *Bisaccioides cuspatus* sp. nov. Holotype. (a) and (b) side views, (c) apertural view. P159781.

Fig. 3. *Delosinella planispiralis* sp. nov. Holotype. (a) side view, (b) edge view. P159782.

Fig. 4. *Nonionella excavata* sp. nov. Holotype. (a) umbilical side, (b) spiral side, (c) edge view. P159783.

PLATE 2 (S.E.M. photographs)

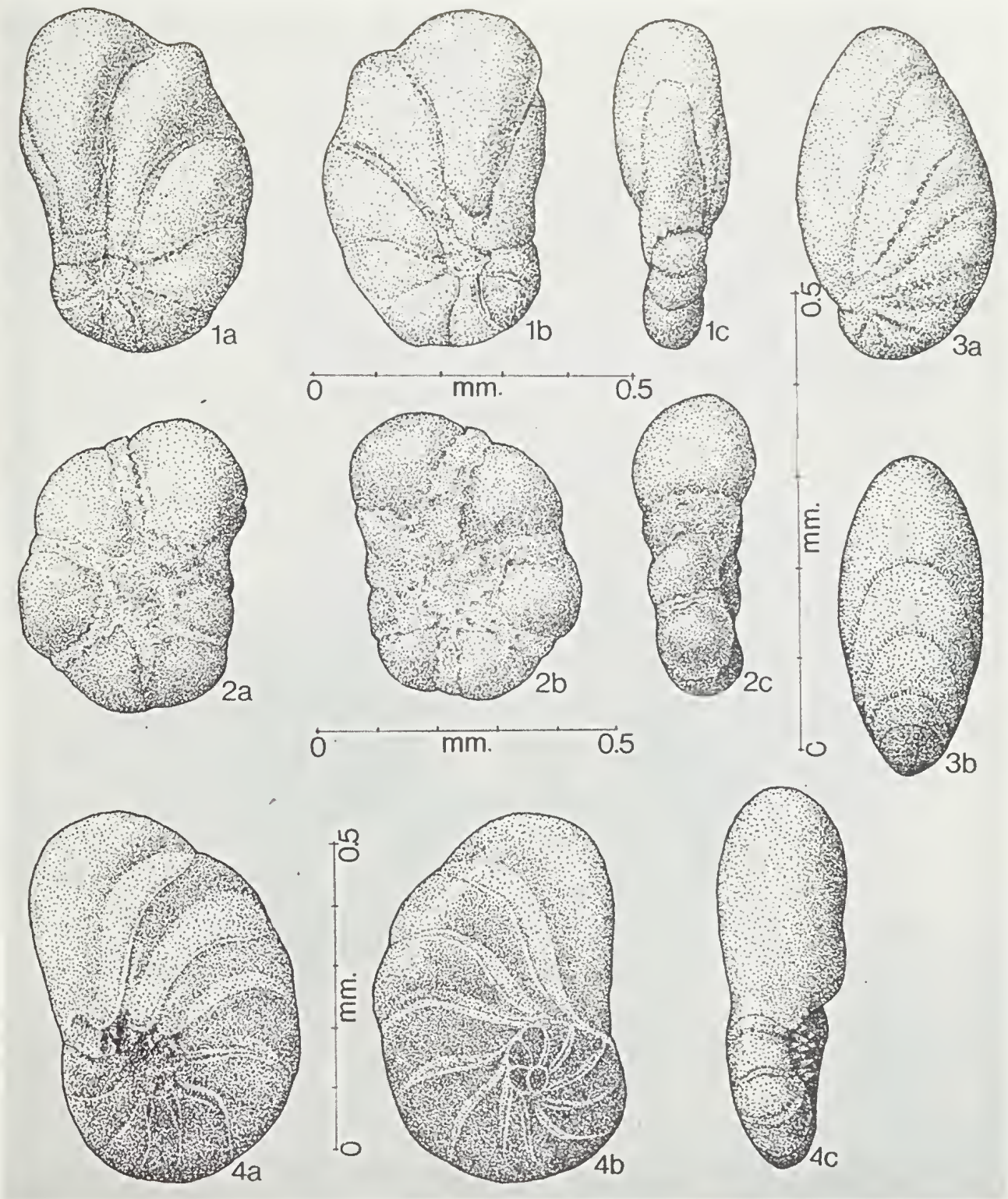
Fig. 1. *Siphotrochammia* aff. *lobata* Saunders, umbilical view x 206. P159784.

Fig. 2. *Munkiella lingulata* sp. nov. (a) side view, (b) apertural view. P159785.

Fig. 3. *Bisaccioides cuspatus* sp. nov. (a) side view x 140, (b) apertural view x 163. P159786.

Fig. 4. *Delosinella planispiralis* sp. nov. side view x 206. P159787.

Fig. 5. *Nonionella excavata* sp. nov. Umbilical view x 230. P159788.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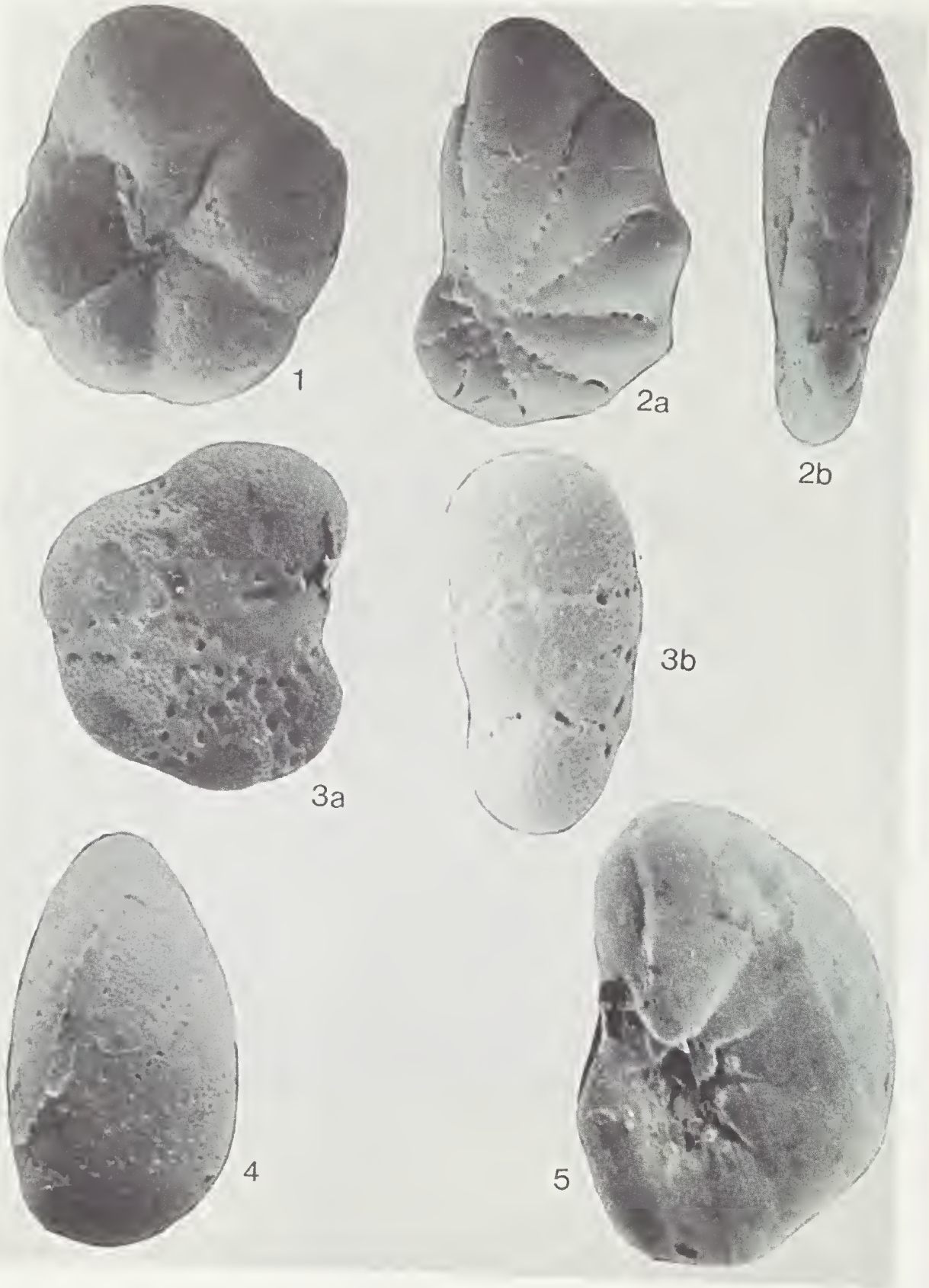
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