

NEW AND RENAMED SPECIES OF BENTHIC FORAMINIFERA FROM THE PLEISTOCENE SANTA BARBARA FORMATION OF CALIFORNIA

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ABSTRACT—Ten new species of benthic foraminifera are described from the early to middle Pleistocene Bathhouse Beach locality of the Santa Barbara Formation, Santa Barbara, California. The new taxa include *Glabratella luxuribulla* n. sp., *Rectobolivina ruida* n. sp., *Homalohedra jungocostata* n. sp., *Homalohedra quasilineata* n. sp., *Pytine lemniscata* n. sp., *Lagena complurecosta* n. sp., *Lagena compressacosta* n. sp., *Cerebrina adamanta* n. sp., *Fissurina artolabiata* n. sp., and *Fissurina infragilella* n. sp. *Palliolatella immemora* is proposed as a replacement name for the primary homonym *Lagena neglecta* Buchner, 1940.

INTRODUCTION

THE FORAMINIFERA of the early to middle Pleistocene Bathhouse Beach locality (also known as Breakwater Beach) of the Santa Barbara Formation (Figure 1) have been described qualitatively by several workers (Bagg, 1912; Loeblich and Tappan, 1963; Young, 1979, 1981). The locality has also been indirectly studied in qualitative comparisons with other southern California Pleistocene units such as the Lomita Marl (Galloway and Wissler, 1927) and the exposure of Timm's Point Silt Member of the San Pedro Formation (Cushman and Gray, 1946a, 1946b). The fauna has also been compared qualitatively with foraminiferal faunas of the modern banks, ridges, and terraces of the California Borderland (Emery, 1960; Blake, 1976; Douglas et al., 1979; Douglas, 1981).

Most recently, Patterson et al. (1990) examined quantitatively the benthic and planktonic foraminiferal populations of this locality. A census of 93 species of benthic foraminifera and nine species of planktonic foraminifera was compiled from 11 samples from the shelly marls, silts, and sands of the Lower Member. Most species of benthic foraminifera are rare and only 38 species comprise one percent or more of the population in one or more samples. Based on the fractional abundances of benthic foraminifera, Patterson et al. (1990) recognized two transgressive events during deposition of these sediments (between 0.9 and 0.4 million years ago). Analysis of the planktonic foraminiferal populations obtained from these samples indicates a warm interval during deposition of the basal sediments. Temperatures became considerably cooler later, but during deposition of the uppermost sampled sediments a water mass of intermediate temperature was present (Patterson et al., 1990). In a separate qualitative examination of larger aliquots from these samples, 129 species of benthic foraminifera and nine species of planktonic foraminifera were observed. In a paleoenvironmental analysis it was determined that 11 of the rarer species of benthic foraminifera were undescribed. The purpose of this paper is to describe and fully illustrate these new taxa.

METHODS AND MATERIALS

Eleven samples of approximately five kg each were collected from the lower member of the Santa Barbara Formation (Figures 1, 2).

Samples were collected at the following intervals:

- S1. (Patterson Cat. #31) 6.0 m from north end of road cut.
- S2. (Patterson Cat. #32) 13.8 m from north end of road cut.
- S3. (Patterson Cat. #33) 22.0 m from north end of road cut.
- S4. (Patterson Cat. #34) 26.0 m from north end of road cut.
- S5. (Patterson Cat. #35) 32.0 m from north end of road cut.

- S6. (Patterson Cat. #36) 37.0 m from north end of road cut.
- S7. (Patterson Cat. #37) 45.0 m from north end of road cut.
- S8. (Patterson Cat. #38) 52.0 m from north end of road cut.
- S9. (Patterson Cat. #39) 62.8 m from north end of road cut.
- S10. (Patterson Cat. #40) 67.4 m from north end of road cut.
- S11. (Patterson Cat. #41) 71.4 m from north end of road cut.

Sampling intervals varied to avoid sampling from slumps, thick vegetation, and indurated marls difficult to disaggregate for extraction of microfossils. Samples were dried, disaggregated in a solution of boiling soda ash, and washed over a sieve of 200 Tyler equivalent mesh size (75 μ m openings). Several thousand specimens of benthic and planktonic foraminifera were examined during the qualitative analysis and approximately 300–500 specimens were examined for the quantitative analysis.

SYSTEMATIC PALEONTOLOGY

Many of these species were quantified by Patterson et al. (1990) and designated as "sp." The new species so designated in that paper and described herein are noted in the respective "Remarks" sections. Fractional abundances of such taxa at various Bathhouse Beach horizons may be determined by reference to Patterson et al. (1990, table 1). Generic and suprageneric designations follow Loeblich and Tappan (1987). Holotypes and paratypes of the new species are deposited in the micropaleontological collections of the Geological Survey of Canada, Ottawa.

- Order FORAMINIFERIDA Eichwald, 1830
- Suborder LAGENINA Delage and Hérouard, 1896
- Superfamily NODOSARIACEA Ehrenberg, 1838
- Family NODOSARIIDAE Ehrenberg, 1838
- Family LAGENIDAE Reuss, 1862
- Genus LAGENA Walker and Jacob in Kanmacher, 1798
- LAGENA COMPLURECOSTA n. sp.
- Figure 3.1–3.3

Lagena sp. 1 PATTERSON, BRUNNER, CAPO, AND DAHL, 1990, p. 16.

Diagnosis.—Subglobular species of *Lagena* with costae extending from base to phialine-lipped aperture.

Description.—Test free, unilocular, subglobular with elongate neck, circular in section; wall calcareous, hyaline, finely perforate; 13–16 longitudinal costae, most of which extend from the base to aperture; aperture circular within phialine lip.

Etymology.—From the Latin, *complures*, several, many, plus *costa*, rib, with reference to the numerous costae.

Types and occurrence.—Figured holotype (G.S.C. 98298) from sample 5. Unfigured paratype (G.S.C. 98299) from sample 2. This species was only found at these horizons.

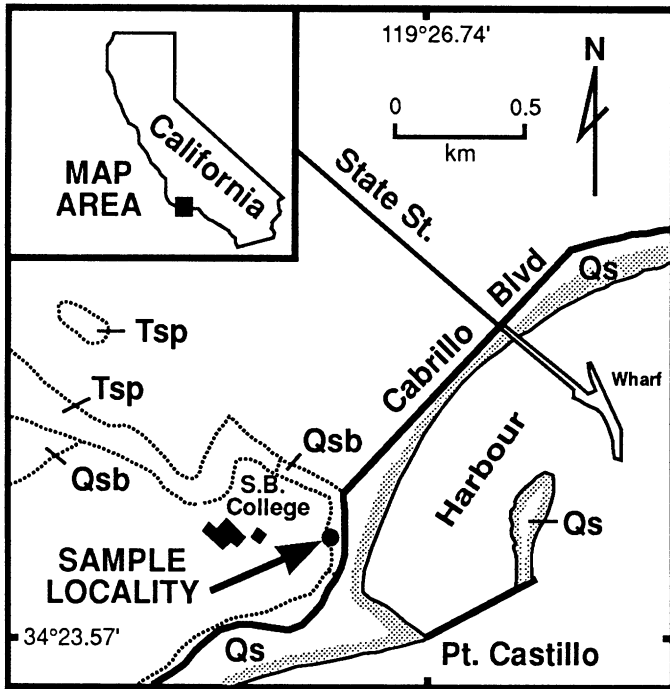


FIGURE 1—Geologic map showing Pleistocene Bathhouse Beach locality of the Santa Barbara Formation, Santa Barbara, California. Tsp, Sespe Formation (Oligocene); Qsb, Santa Barbara Formation (Pleistocene); Qs, surficial sediments (after Dibblee, 1966).

Dimensions.—Maximum length, 325 μm ; maximum width, 105 μm .

Remarks.—*Lagena complurecosta* is most similar to *Lagena sesquistriata* Bagg, 1912, and *Lagena mexicana* Andersen, 1961, but differs from these species in having twice as many costae. *Lagena filicosta* Reuss, 1863, is also very similar but has a costae-free neck.

LAGENA COMPRESSACOSTA n. sp.
Figure 3.4–3.8

Lagena sp. 2 PATTERSON, BRUNNER, CAPO, AND DAHL, 1990, p. 16.

Diagnosis.—Species of *Lagena* characterized by six pairs of closely spaced longitudinal costae.

Description.—Test free, elongate, with subglobular main chamber, circular in cross section; wall calcareous, translucent, with no pores penetrating outer surface; six pairs of wide, closely spaced costae extend from the base and terminate on the narrow, elongate neck; aperture small and circular with phialine lip; no entosolenian tube observed.

Etymology.—From the Latin, *compressus*, pressed together, plus *costa*, rib, with reference to the paired arrangement of the longitudinal costae.

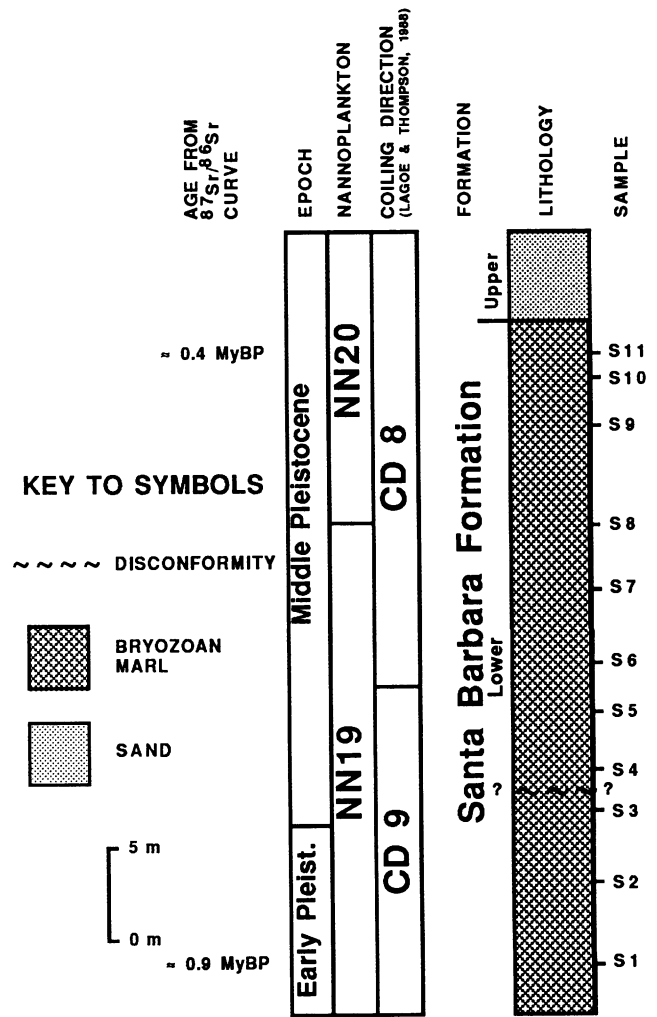


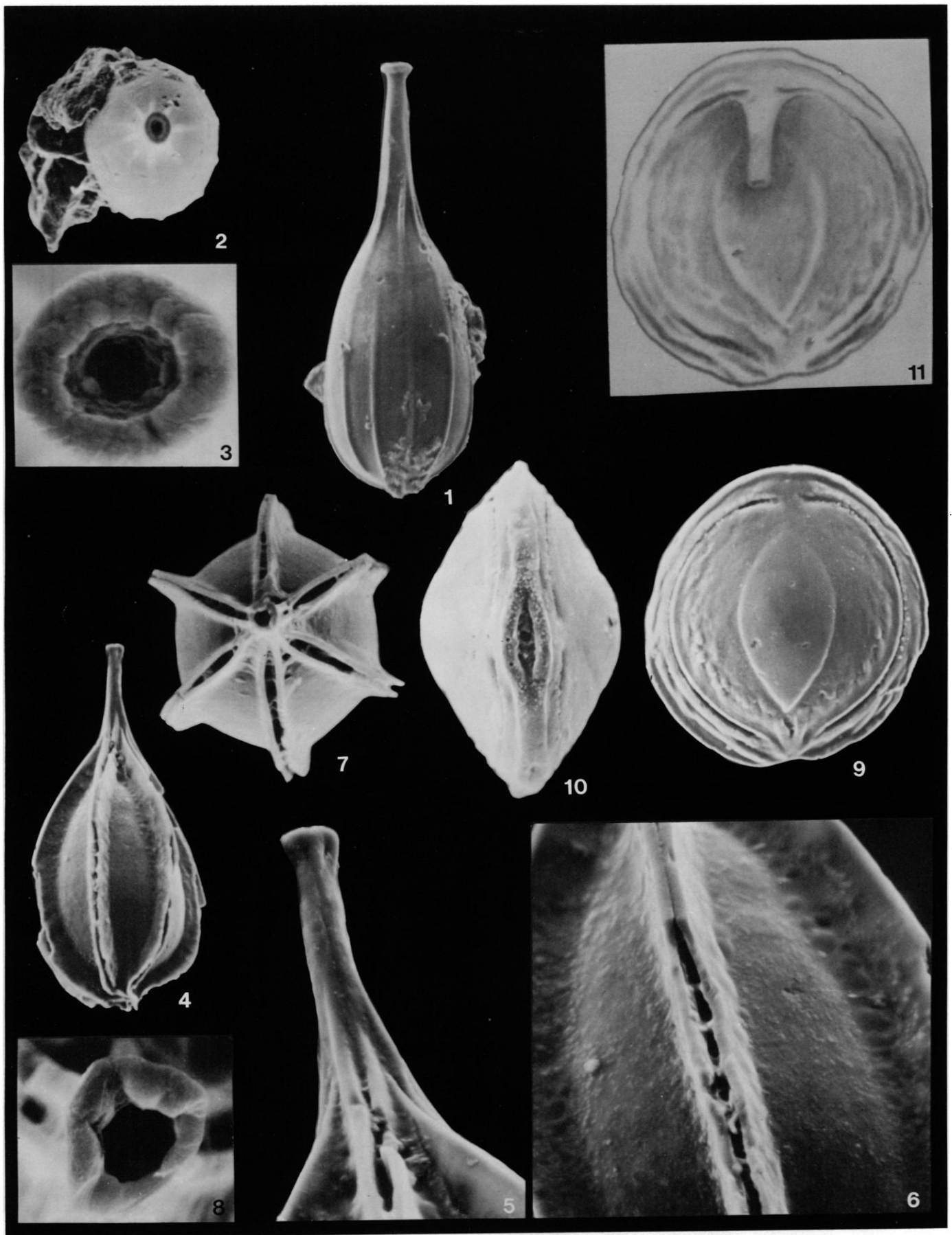
FIGURE 2—Bathhouse Beach stratigraphic section showing age of unit, sampled intervals, and lithology (redrafted after Patterson et al., 1990).

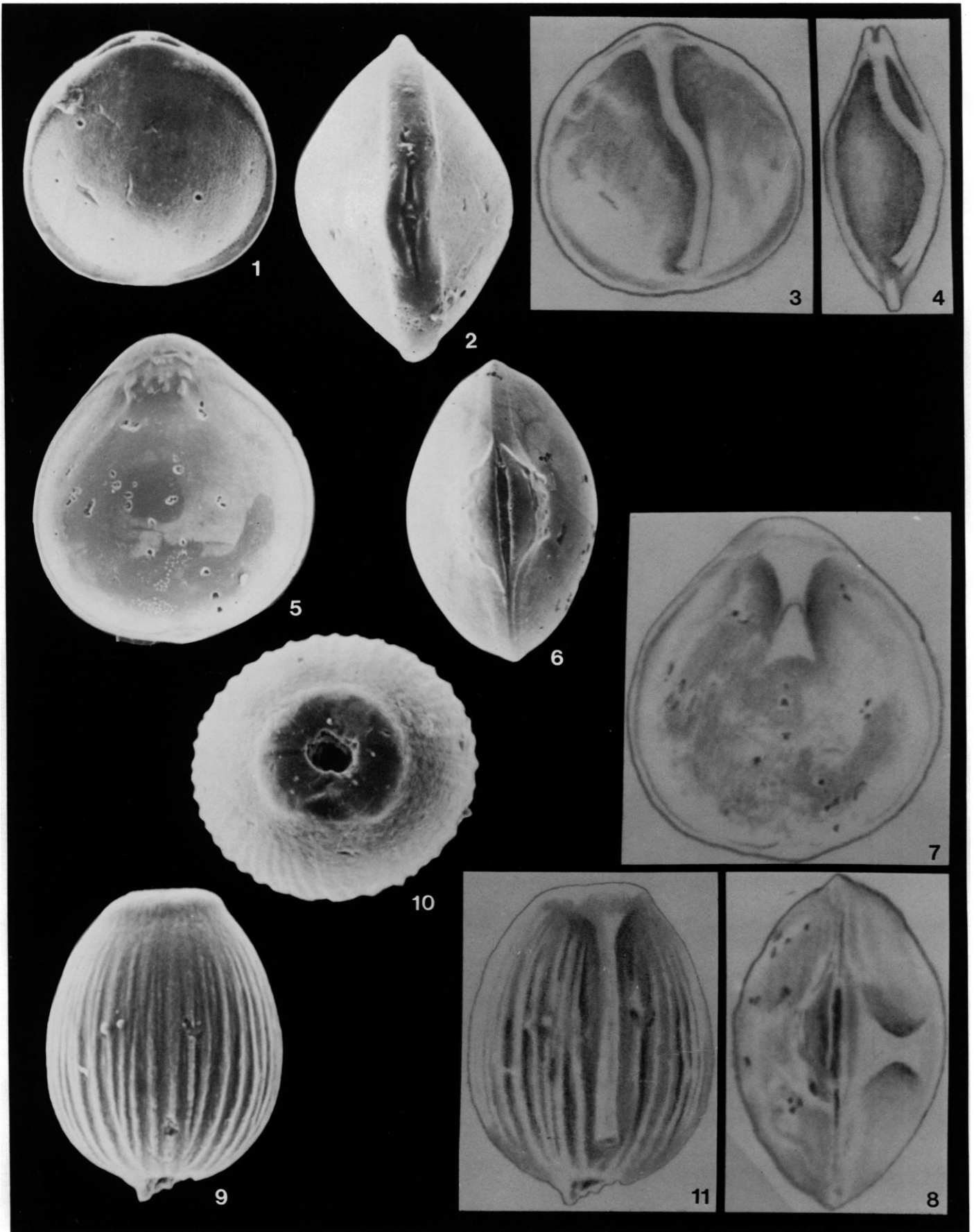
Dimensions.—Maximum length, 255 μm ; maximum width, 115 μm .

Types and occurrence.—Figured holotype (G.S.C. 98300) from sample 1; unfigured paratypes (G.S.C. 98301) from sample 6 and from sample 10 (G.S.C. 98302). Found in all sampled horizons at the Bathhouse Beach locality except sample 4.

Remarks.—*Lagena compressacosta*, with the characteristic closely spaced pairs of costae, is distinct from all other species of the genus. However, when the longitudinal costae are chipped the species can easily be confused with the punctate *Strictocostella striatopunctata* (originally described as *Lagena striato-*

FIGURE 3—1–3, *Lagena complurecosta* n. sp., holotype (G.S.C. 98298). 1, side view showing subglobose chamber with elongate neck and phialine lip, $\times 255$; 2, apertural view showing circular cross section, $\times 290$; 3, enlargement of aperture showing smooth phialine lip surrounding circular aperture, $\times 2,000$. 4–8, *Lagena compressacosta* n. sp., holotype (G.S.C. 98300). 4, side view showing subglobose chamber and elongate neck, $\times 280$, sample 1; 5, enlargement of neck showing longitudinal costae terminating partway up elongate, narrow neck, $\times 940$; 6, enlargement of chamber showing closely appressed and wide longitudinal costae, $\times 950$; 7, apertural view showing circular cross section and relatively few appressed pairs of longitudinal costae, $\times 490$; 8, enlargement of circular aperture showing irregular phialine lip, $\times 2,030$. 9–11, *Ceprina adamanta* n. sp. holotype (G.S.C. 98303). 9, side view showing circular outline and lozenge-shaped surface sculpture on face, $\times 220$ (sample 2); 10, apertural view showing compressed test, and circular aperture within a fissurine slit, $\times 300$; 11, sketch of side view showing short, straight entosolenian tube, $\times 244$.





punctata Parker and Jones, 1865) under reflected light microscopy.

Family ELLIPSOLAGENIDAE A. Silvestri, 1923
Subfamily ELLIPSOLAGENINAE A. Silvestri, 1923
Genus CEREBRINA Patterson, 1986
CEREBRINA ADAMANTA n. sp.
Figure 3.9–3.11

Cerebrina sp. 1 PATTERSON, BRUNNER, CAPO, AND DAHL, 1990, p. 11.

Diagnosis.—Species of *Cerebrina* with elevated fusiform-shaped area on each test face.

Description.—Test free, unilocular, compressed, circular in side view; wall calcareous, hyaline, finely perforate; large marginal carina encircles test and two smaller sets of marginal carina separated by incised area extend from near base to near aperture; each test face characterized by central smooth-surfaced, lozenge-shaped elevated region with apices oriented toward test base and aperture, remainder of each test face roughened, with numerous protuberances; circular aboral end of the entosolenian tube visible within fissurine aperture, entosolenian tube short and straight.

Etymology.—From the Latin, *adamanteus*, like a diamond or lozenge, with reference to the elevated lozenge-shaped region on each test face.

Dimensions.—Maximum length, 260 μm ; maximum width, 250 μm ; maximum thickness, 170 μm .

Types and occurrence.—Figured holotype (G.S.C. 98303) from sample 2. Unfigured paratypes (G.S.C. 98304) from sample 3 and sample 4 (G.S.C. 98305). Found in all samples except sample 1.

Remarks.—*Cerebrina adamanta* n. sp. is most similar to *Lagena pseudoorbignyana* var. *tumulosa* Buchner, 1940, but differs in having the smooth-surfaced, elevated, lozenge-shaped region on each face.

Genus FISSURINA Reuss, 1850

FISSURINA ARTOLABIATA n. sp.
Figure 4.1–4.4

Diagnosis.—Species of *Fissurina* characterized by thick lateral carina bifurcating around aperture, and attached entosolenian tube.

Description.—Test free, unilocular, circular in side view, compressed; wall calcareous, hyaline, smooth, finely perforate; a thick lateral carina completely encircles test, bifurcating around aperture; oblong aboral end of entosolenian tube visible within fissurine aperture, entosolenian tube becoming attached and terminating in flared opening near base.

Etymology.—From the Latin, *artus*, narrow, plus *labiatus*, lipped, with reference to the narrow lateral carina encircling aperture.

Dimensions.—Maximum length, 180 μm ; maximum width, 170 μm ; maximum thickness, 100 μm .

Types and occurrence.—Figured holotype (G.S.C. 98306) from sample 1. Unfigured paratypes from sample 2 (G.S.C. 98307)

and from sample 5 (G.S.C. 98308). This species was found only in samples 1, 2, and 5.

Remarks.—*Fissurina artolabiata* n. sp. is very similar to *Lagena modesta* Matthes, 1939, but that species has a short straight entosolenian tube as opposed to the attached entosolenian tube in *Fissurina artolabiata*.

FISSURINA INFRAGILELLA n. sp.
Figure 4.5–4.8

Fissurina sp. 1 PATTERSON, BRUNNER, CAPO, AND DAHL, 1990, p. 12.

Diagnosis.—Robust species of *Fissurina* with attached entosolenian tube and two opaque regions on each test face.

Description.—Test free, unilocular, almost circular in side view; wall calcareous, thick, hyaline, smooth, finely perforate; two wide longitudinal opaque regions bracket each test face; aperture small and circular within fissurine opening; entosolenian tube becoming attached and terminating in flared opening one third of way down the inner wall of test.

Etymology.—From the Latin, *infragilis*, unbreakable, strong, plus *-ella*, diminutive, in reference to the robust test.

Types and occurrence.—Figured holotype (G.S.C. 98309) from sample 1. Unfigured paratypes (G.S.C. 98310) from sample 3. Found in all samples except sample 10.

Remarks.—*Fissurina infragilella* n. sp. is similar to *Entosolenia marginata* (Montagu) var. *lucida* Williamson, 1848, but differs in being more robust and more circular in side view and by having the opaque region separated along the lateral margins, as opposed to being horseshoe-shaped as in the Williamson species. These opaque regions do not show up on scanning electron microscope images but are clearly visible under reflected light. The sketch (Figure 4.7) clearly shows these light-colored bands along the periphery. The present species differs from *Fissurina eumarginata* McCulloch subspecies *oblata* McCulloch, 1977, by having an attached entosolenian tube in contrast to a free-hanging one as in McCulloch's species.

Subfamily OOLININAE Loeblich and Tappan, 1961
Genus HOMALOHEDRA Patterson and Richardson, 1987
HOMALOHEDRA JUNGOCOSTATA n. sp.
Figure 5.1–5.4

Homalohedra sp. 1 PATTERSON, BRUNNER, CAPO, AND DAHL, 1990, p. 16.

Diagnosis.—Species of *Homalohedra* with anastomosing ribs and entosolenian tube becoming attached to one side.

Description.—Test free, unilocular, elongate, circular in cross section; wall calcareous, hyaline, finely perforate; 20–26 longitudinal costae, most anastomosing, extend from base to aperture; short basal process present on some specimens; aperture small and circular within depressed disk, longitudinal costae terminate in this disk around aperture; entosolenian tube becoming attached to one wall and ending near test base.

Etymology.—From the Latin, *junge*, *junctus*, unite, connect, plus *costatus*, ribbed, with reference to the anastomosing ribs.

←
FIGURE 4—1–4, *Fissurina artolabiata* n. sp. 1, holotype (G.S.C. 98306), side view showing carinate, circular outline, and smooth surface, $\times 270$, sample 1; 2, apertural view showing compressed test and circular aperture within fissurine slit, $\times 370$; 3, sketch of side view showing entosolenian tube becoming attached and terminating near the base of the test, $\times 287$; 4, sketch of edge view showing entosolenian tube, $\times 303$. 5–8, *Fissurina infragilella* n. sp. smooth surfaced holotype (G.S.C. 98309). 5, side view, $\times 120$, sample 1; 6, apertural view showing elongate fissurine slit, $\times 145$; 7, sketch of side view showing flared entosolenian tube becoming attached and terminating one-third the distance down the test, $\times 132$; 8, sketch of apertural view showing attached entosolenian tube, $\times 160$. 9–11, *Homalohedra quasilineata* n. sp., subglobular holotype (G.S.C. 98314). 9, side view showing numerous fine, anastomosing longitudinal costae, $\times 290$ (sample 5); 10, apertural view showing circular cross section and circular aperture, $\times 330$; 11, sketch of side view showing straight free-hanging entosolenian tube terminating near the base, $\times 300$.

Dimensions.—Maximum length, 250 μm ; maximum width, 150 μm .

Types and occurrence.—Figured holotype (G.S.C. 98311) from sample 1. Unfigured paratype (G.S.C. 98312) from sample 2 and a second unfigured paratype (G.S.C. 98313) from sample 8. Specimens were also found in sample 11.

Remarks.—*Homalohedra jungocostata* is most similar to *Entosolenia lineata* Williamson, 1848, but differs by having an attached entosolenian tube as opposed to a free-hanging one. *Homalohedra jungocostata* may have an exosolen in some specimens, as the depressed disk surrounding the aperture is very similar to that found in *Entosolenia lineata*. *Entosolenia lineata* is known to have a exosolen. *Oolina eucostata* McCulloch, 1977, is similar in shape and in number of costae but has a free-hanging entosolenian tube and its costae do not anastomose as do those of *Homalohedra jungocostata*.

HOMALOHEDRA QUASILINEATA n. sp.

Figure 4.9–4.11

Homalohedra sp. 2 PATTERSON, BRUNNER, CAPO, AND DAHL, 1990, p. 16.

Diagnosis.—Costate species of *Homalohedra* with free-hanging entosolenian tube terminating at test base.

Description.—Test free, subglobular, circular in section; wall calcareous, hyaline, finely perforate; 40–50 longitudinal costae extend from short basal process to aperture although some costae anastomose and other costae are discontinuous; test slightly constricted at small, round aperture with thick noncostate rim; entosolenian tube hanging free in center of chamber and terminating near test base.

Etymology.—From the Latin, *quasi*, appearing as if, simulating, plus *lineata*, name of a unilocular species described by Williamson (1848) with reference to the similarity of the present species to that previously described.

Dimensions.—Maximum length, 200 μm ; maximum width, 160 μm .

Types and occurrence.—Figured holotype (G.S.C. 98314) from sample 5. Unfigured paratype (G.S.C. 98315) from sample 2. This species was only found in samples 1, 2, and 5.

Remarks.—*Homalohedra quasilineata* n. sp. closely resembles *Entosolenia lineata* Williamson, 1848, but has more distinct longitudinal costae.

Genus PALLIOLATELLA Patterson and Richardson, 1987

PALLIOLATELLA IMMEMORA new name

Figure 5.5, 5.6, 5.9, 5.10

Lagena neglecta BUCHNER, 1940, p. 503, Pl. 19, fig. 405 (not *Lagena neglecta* Buchner, 1940, p. 463, Pl. 11, figs. 173–178).

Palliولاتella n. sp. PATTERSON, BRUNNER, CAPO, AND DAHL, 1990, p. 20.

Diagnosis.—Species of *Palliولاتella* with a marginal carina completely encircling test and an entosolenian tube becoming attached to one wall.

Description.—Test free, unilocular, compressed, oblong in side view; wall calcareous, hyaline, smooth, finely perforate; thin marginal carina completely encircling test becomes much wider on short neck, outer margin of carina also thickens on neck forming recurved area around aperture; aperture small and circular within narrow fissurine slit; entosolenian tube becoming attached to one wall and terminating near test base.

Etymology.—From the Latin, *immemor*, -is, unmindful, forgetful, with reference to the many years this species spent in nomenclatural limbo.

Types and occurrence.—Figured hypotype (G.S.C. 98316) from sample 1. Specimens were found in all samples except sample 2.

Remarks.—*Palliولاتella neglecta* (Buchner, 1940), is a primary homonym of *Lagena neglecta* Buchner, 1940, (p. 463, Pl. 11, figs. 173–178) and was reported as such by Thalmann (1947) although he proposed no new name. A new name is designated for this species using the principle of first revisor (ICZN Art. 24 [a]).

Subfamily SIPHOLAGENINAE Patterson and Richardson, 1988

Genus PYTINE Moncharmont-Zei and Sgarrella, 1978

PYTINE LEMNISCATA n. sp.

Figure 5.7, 5.8, 6.1–6.5

Pytine sp. 1 PATTERSON, BRUNNER, CAPO, AND DAHL, 1990, p. 22.

Diagnosis.—Species of *Pytine* with costae widening to form overlapping ribbon-like straps.

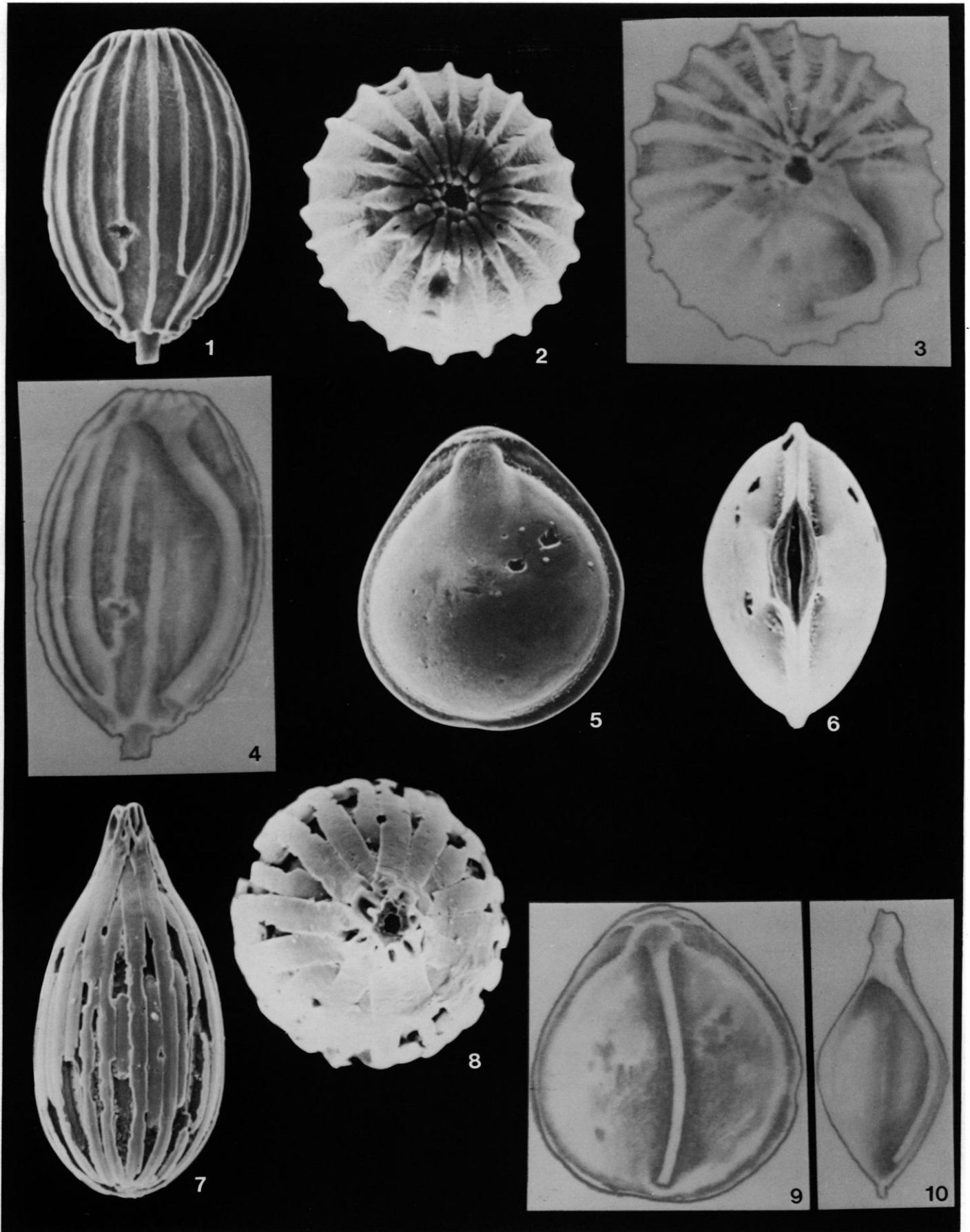
Description.—Test free, unilocular, subglobular, elongate, circular in cross section; wall calcareous, translucent, smooth, outer layer may be perforate within gaps between overlapping costae; inner wall coarsely perforate in longitudinal spaces between costae; numerous longitudinal costae extend from test base to base of elongate neck, shorter longitudinal costae lie between longer ones; costae narrow near base but then broaden, forming wide overlapping ribbon-like straps that completely cover test surface to form outer wall; shorter irregular longitudinal costae cover neck; aperture small and circular within phialine lip with incised radiating grooves; entosolenian tube short and straight.

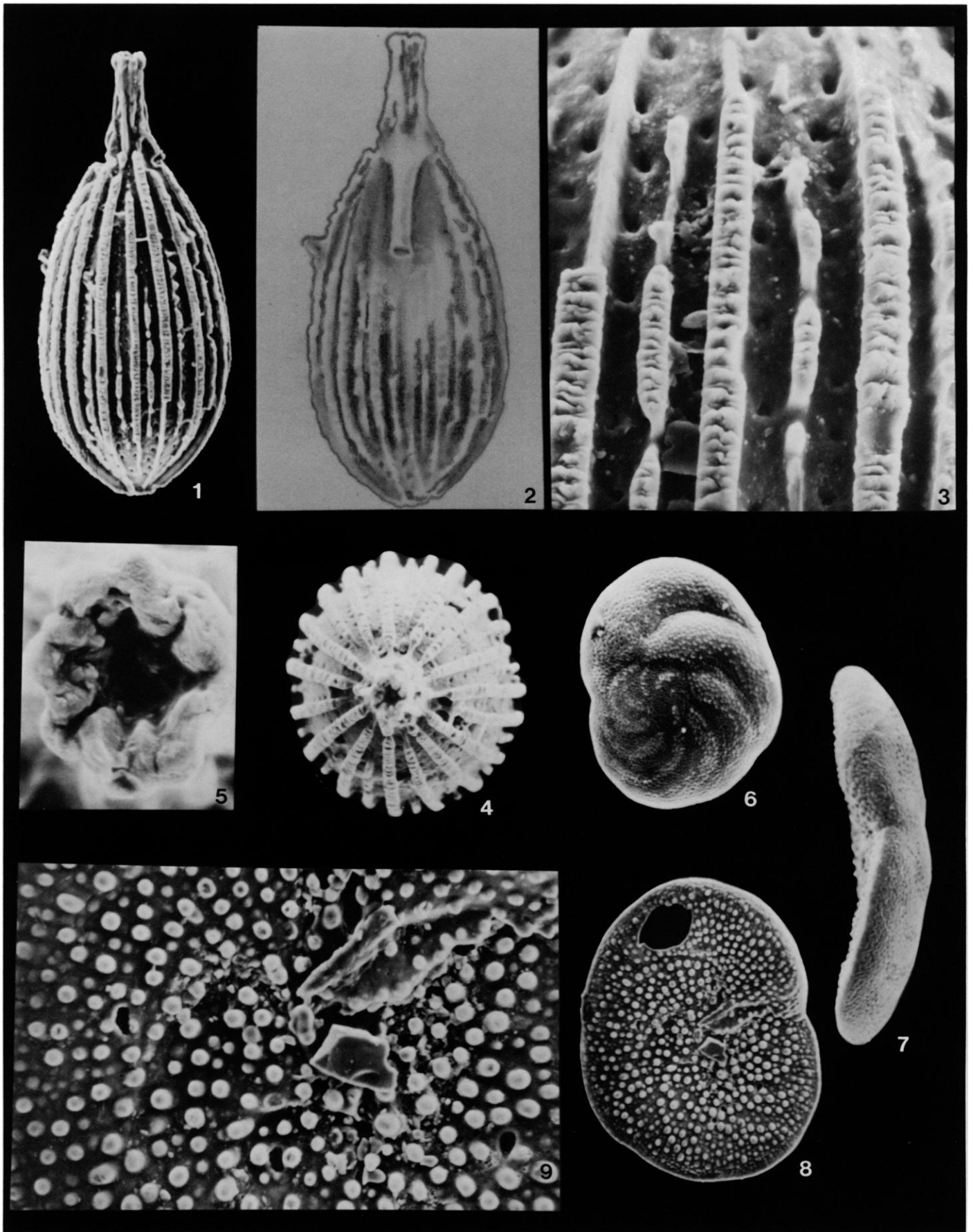
Etymology.—From the Latin, *lemniscatus*, adorned with ribbons, with reference to the modified longitudinal costae of the species.

Dimensions.—Maximum length, 430 μm ; maximum width, 180 μm .

Types and occurrence.—Figured holotype (G.S.C. 98317) and figured paratype (G.S.C. 98318) from sample 1. Unfigured paratypes (G.S.C. 98319) are from sample 3. Specimens are present in all samples except sample 9.

FIGURE 5—1–4, *Homalohedra jungocostata* n. sp. holotype (G.S.C. 98311). 1, side view showing barrel-shape, anastomosing longitudinal costae, and basal spine, $\times 265$, sample 1; 2, apertural view showing longitudinal costae terminating in a ring around the circular aperture, $\times 560$; 3, sketch of apertural view showing entosolenian tube becoming attached to test wall, $\times 618$; 4, sketch of side view showing entosolenian tube becoming attached and terminating near the test base, $\times 290$. 5, 6, 9, 10, *Palliولاتella immemora* new name, hypotype (G.S.C. 98316). 5, side view showing relatively broad carina encircling test and small palliolatelline hood in the apertural region, $\times 270$ (sample 1); 6, apertural view showing compressed test and fissurine apertural slit, $\times 300$; 9, sketch of side view showing entosolenian tube becoming attached and terminating near the base of the test, $\times 270$; 10, sketch of edge view showing entosolenian tube, $\times 270$. 7, 8, *Pytine lemniscata* n. sp., holotype (G.S.C. 98317). 7, side view showing broad, overlapping, straplike longitudinal costae of outer layer, $\times 190$, sample 1; 8, apertural view showing circular cross section, $\times 280$.





Remarks.—*Pytine lemniscata* n. sp. is most similar to *Pytine petaloskelis* Patterson and Richardson, 1988, but differs in the wider longitudinal costae that completely encompass the test of the present species. *Pytine petaloskelis* also is much more elongate and has a noncostate neck.

Suborder ROTALIINA Delage and Hérouard, 1896

Superfamily GLABRATELLACEA Loeblich and Tappan, 1964

Family GLABRATELLIDAE Loeblich and Tappan, 1964

Genus GLABRATELLA Dorreen, 1948

GLABRATELLA LUXURIBULLA n. sp.

Figures 6.6–6.9, 7.1, 7.2

Planulina wuellerstorfi (Schwager). CUSHMAN AND GRAY, 1946b, p. 45, Pl. 8, fig. 13a–c (not *Truncatulina wuellerstorfi* Schwager, 1866).

Neoconcorbina opercularis (d'Orbigny). LANKFORD AND PHLEGER, 1973, p. 123, Pl. 4, fig. 29a–c (not *Rosalina opercularis* d'Orbigny, 1839).

Glabratella sp. 1 PATTERSON, BRUNNER, CAPO, AND DAHL, 1990, p. 12.

Diagnosis.—A species of *Glabratella* with strongly curved sutures, and pronounced papillae around the umbilicus.

Description.—Test free, planoconvex, compressed, wall calcareous, hyaline, coarsely perforate on spiral side; all chambers visible on convex spiral side, only final seven chambers visible on umbilical side; sutures depressed and curved; umbilical side covered with radiating papillae becoming larger near umbilicus; aperture an umbilical opening.

Etymology.—From the Latin, *luxuria*, profusion, rankness, excess, extravagance, plus *bulla*, knob, boss, stud, bubble, with reference to papillae that cover umbilical surface of test.

Dimensions.—Maximum width, 500 μm ; maximum thickness; 75 μm .

Types and occurrence.—Figured holotype (G.S.C. 98320) from sample 2. Attached figured paratypes (G.S.C. 98321) from sample 1. Unfigured paratype (G.S.C. 98322) from sample 8. A second unfigured paratype (G.S.C. 98323) is from sample 1. This species was found in all samples.

Remarks.—*Glabratella luxuribulla* is similar to *Rosalina opercularis* d'Orbigny, 1839, but differs by having fewer chambers per whorl, papillae on the umbilical side, and more strongly curved chambers. Reproduction in this species is by plastogamy, with the two parent tests attached by their umbilical faces (Figure 7.1, 7.2).

Superfamily BULIMINACEA Jones

in Griffith and Henfrey, 1875

Family SIPHOGENERINOIDIDAE Saidova, 1981

Subfamily SIPHOGENERINOIDINAE Saidova, 1981

RECTOBOLIVINA RUIDA n. sp.

Figure 7.3–7.8

Rectobolivina sp. 1 PATTERSON, BRUNNER, CAPO, AND DAHL, 1990, p. 22.

Diagnosis.—A coarsely punctate species of *Rectobolivina* with a short, lipped neck.

Description.—Test free, elongate, circular in cross section; wall calcareous, hyaline, coarsely perforate, each pore surrounded by raised hexagonal rim, forming reticulate network over

entire test surface; test initially compressed and biserial for first three pairs of chambers, then becoming uniserial and oblate to circular in cross section; aperture circular and terminal with lipped rim; a hemicylindrical internal tooth-plate alternates in position 180° between forams of successive chambers.

Etymology.—From the Latin, *ruidus*, rough, with reference to the test surface texture.

Types and occurrence.—Figured holotype (G.S.C. 98324) from sample 1; figured paratype (G.S.C. 98325) and unfigured paratype (G.S.C. 98326) both from sample 2. Specimens were found in samples 1, 2, and 7.

Remarks.—*Rectobolivina ruida* is differentiated from *Rectobolivina clippertonensis* McCulloch, 1977, by having an apertural lip and in lacking longitudinal costae. The present species is distinguished from *Sagrina columellaris* Brady, 1881, by having more depressed sutures and by being more coarsely perforate and ornamented.

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FIGURE 6—1–5, *Pytine lemniscata* n. sp., paratype (G.S.C. 98318). 1, side view with flattened outer costae removed and elongate neck intact, $\times 200$, sample 1; 2, sketch of side view showing short straight entosolenian tube, $\times 212$; 3, enlargement of side showing single row of coarse perforations on inner wall between longitudinal costae, $\times 940$; 4, apertural view showing numerous costae, $\times 290$; 5, enlargement of aperture showing circular opening within the radiate, phialine lip, $\times 1,500$. 6–9, *Glabratella luxuribulla* n. sp., coarsely perforate holotype (G.S.C. 98320). 6, dorsal view showing all whorls and strongly curved sutures that become depressed in later chambers, $\times 110$, sample 2; 7, edge view showing extremely compressed test, $\times 200$; 8, umbilical view showing radiating rows of pustules covering surface, $\times 145$; 9, enlargement of umbilical region showing apertural slit extending from the umbilicus to outer margin of test, $\times 395$.

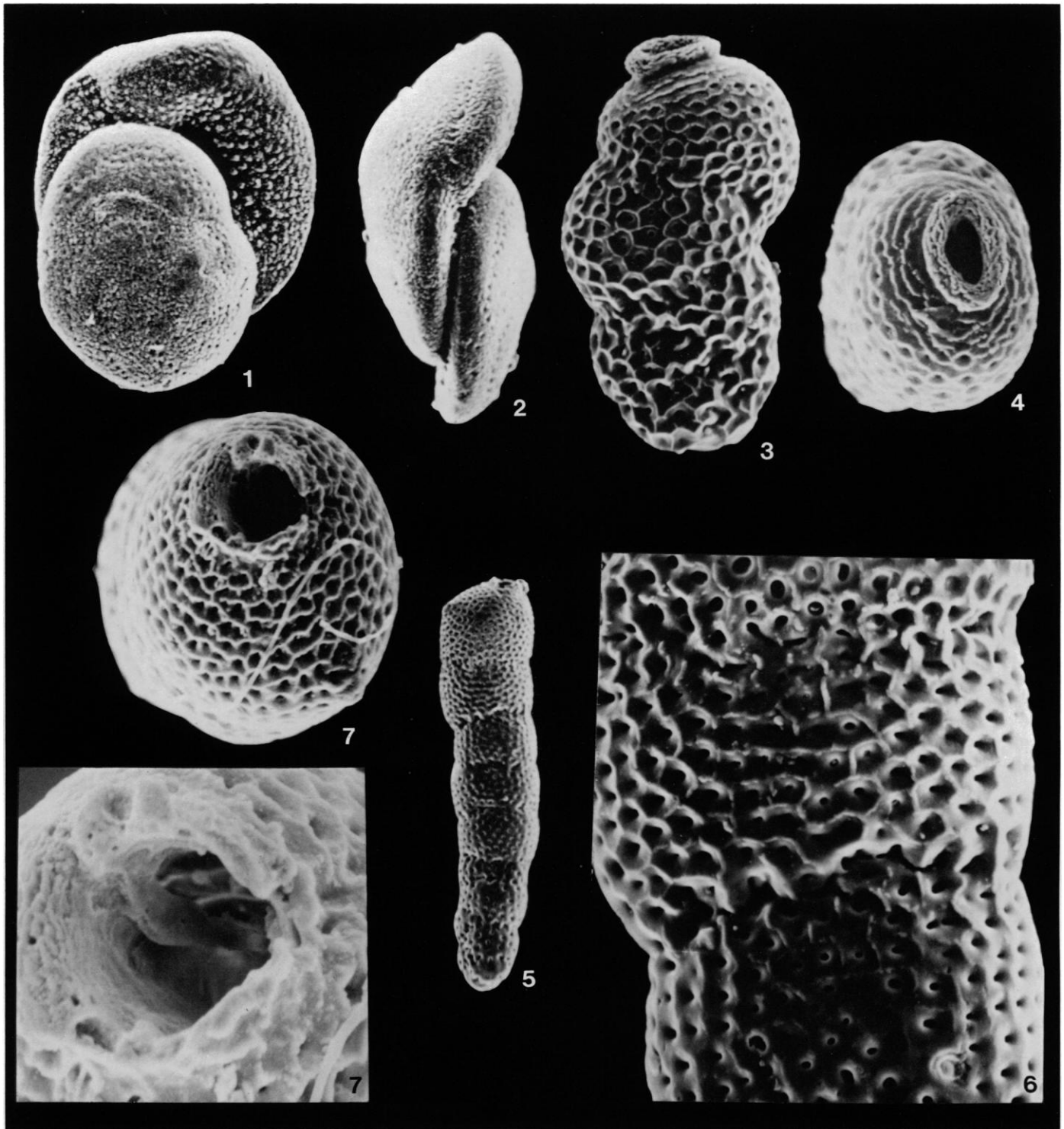


FIGURE 7—1,2, *Glabratella luxuribulla* n. sp. 1, side view of two paratypes (G.S.C. 98322) plastogamously attached by their umbilical sides, $\times 230$, sample 1; 2, edge view of same showing the umbilical region attachment, $\times 260$; 3—8, *Rectobolivina ruida* n. sp. 3, side view of juvenile paratype (G.S.C. 98325) showing raised apertural rim, $\times 300$, sample 2; 4, apertural view of same showing circular raised rim around aperture, $\times 310$; 5, side view of holotype (G.S.C. 98324) showing elongate, coarsely perforate test, $\times 100$, sample 1; 6, enlargement of test surface showing network of raised hexagonal rims around pores, $\times 460$; 7, apertural view of showing circular cross section, $\times 310$; 8, enlargement of damaged (apertural rim is missing) apertural region showing internal tooth-plate, $\times 770$.

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