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A TAXONOMIC REVISION OF THE UNILOCULAR FORAMINIFERA

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ABSTRACT

Unilocular foraminifera are varied and diverse, yet among the least understood gronp of the foraminifera. Part of the problem has been the inadequate number of taxonomic divisions within this varied group. We propose a new taxonomic framework to make the group more useful to taxonomists and stratigraphers alike, and to eventually lead to a better understanding of the group as a whole.

Rather than subdividing the unilocular foraminifera into more than one family, we reinstate the family Lagenidae Reuss, 1862, to include all unilocular forms, and recognize three subfamilies. The first subfamily, Lageninae Reuss, 1862, encompasses genera that lack an entosolenian tube, including *Lagena* Walker and Jacob, and the reinstated *Procerolagena* Puri. The second subfamily, Ellipsolageninae Silvestri, 1923, accommodates genera with an entosolenian tube at some stage of the life cycle, including *Oolina* d'Orbigny, *Cushmanina* Jones, *Fissurina* Reuss, *Galwayella* Patterson and Pettis, *I renita* Jones, *Lagenosolenia* McCulloch, *Parafissurina* Parr, *Pseudofissurina* Jones, *Pseudoolina* Jones, *Pseudosolenina* Jones, *Solenina* Jones, *Ventrostoma* Schnjtker, *Walterparria* Jones, and *Wiesnerina* Jones. Four new genera are also included in the Ellipsolagenidae: *Duplella* (type species D. apexadina, n. sp.), *Palliolatella* (type species P. arita, n. sp.), *Pristinosceptrella* (type species P. hispida, n. sp.), and *Vasicostella* (type species V. helophoromarginata (Jones)). We also describe two additional new species belonging to this subfamily: *Vasicostella singulara* and *Wiesnerina carinata.*

We propose a new third subfamily, Sipholageninae, to include those unilocular genera with double walls connected by a network of pillars. This subfamily contains *Sipholagena* Moncharmont-Zei and Sgarrella and *Pytine* Moncharmont-Zei and Sgarrella.

INTRODUCTION

Unilocular foraminifera are varied and diverse, yet one of the least understood groups of foraminifera. The low number of taxonomic divisions within this varied group suggested to us that a rigorous reexamination was needed. We examined several thousand specimens from Holocene localities around the world to gain as wide an exposure as possible to the myriad morphologic variations. In addition, some fossil unilocular foraminifera, as old as Late Cretaceous, were studied to broaden the taxonomic interpretations.

TAXONOMIC HISTORY

Taxonomic difficulties associated with unilocular foraminifera arise in part from their relatively low abundance, high species diversity, and small size. As a result, the group generally has been ignored by most foraminiferal workers.

Prior to Cushman's reclassification of the foraminifera in 1928, most authors followed H. B. Brady (1884) in referring all single-chambered foraminifera to *Lagena* Walker and Jacob. Most of these early workers recognized relatively few species, but a large number of varieties. Monographs on *Lagena.* such as that by Sidebottom (1912, 1913), clearly illustrate this approach.

Cushman (1928) limited the use of *Lagena* to species with or without a neck, having a rounded, radiate, elliptical, or slitlike terminal aperture. He placed *Oolina* d'Orbigny, *Fissurina* Reuss, *Trigonulina* Seguenza, *Amphorina* d'Orbigny, *Vermiculum* Montagu, and other genera in synonomy with *Lagena.* To accommodate species with a rounded test and internal tube, Cushman reinstated *Entosolenia* Williamson and transferred it from the family Lagenidae to the Buliminidae. Cushman also referred lagenid foraminifera with an internal tube and projecting hood to *Ellipsolagena* Silvestri, which he placed in the family Ellipsoidinidae.

Parr (1947) recognized *Lagena, Dolina, Fissurina,* and *Parafissurina* Parr and placed them all in the family Lagenidae. In the conclusion of his revision, Parr acknowledged the inadequacy of the classification of unilocular foraminifera and wrote". . . the writer realizes that the genera he has recognized could justifiably be subdivided into a larger number of genera, . . . (the) double wall seen in some species, . . . the marginal tubes in (some) species, . . . the development of horizontal tubules (of others) . . . are all much more radical differences. . . than the differences on which *Dolina. Lagena. Fissurina,* and *Parafissurina* are separated."

Loeblich and Tappan (1964) recognized *Dolina, Fissurina,* and *Parafissurina* and placed them in the subfamily Oolininae in the family Glandulinidae, based on the presence of entosolenian tubes. They placed *Lagena* in the subfamily Nodosariinae in the family Nodosariidae. *Procerolagena* Puri was placed in synonomy with *Lagena.*

In the most ambitious revision to date, Jones (1984) recognized 23 genera of unilocular foraminifera. In the subfamily Oolininae, Jones recognized *Dolina. Fissurina,* and *Lagenosolenia* along with nine new genera; *Arthurina* Jones (a junior synonym of *Ventrostoma* Schnikter), *Buchnerina* Jones, *Cushmanina* Jones, *Irenita* Jones, *Pseudofissurina* Jones, *Pseudoolina* Jones, *Pseudosolenina* Jones, *Solenina* Jones, and *Wiesnerina* Jones. In the Lingulinidae Loeblich and Tappan, Jones erected the subfamily Rimulininae to include *Rimulina* d'Orbigny and *Rimulinoides* Saidova. *Rimulina* is based on a single specimen, *R. glabra* d'Orbigny,

and although originally described as being multilocular, Loeblich and Tappan (1955) found this not to be evident. Due to the fact that no additional specimens have been found, and that the type level is uncertain, we do not recognize *Rimulina* within the Lagenidae. *Rimulinoides* is described as being cylindrical, with a few transverse growth lines, and with a sieve-like aperture having three radiating grooves. Although Saidova's (1975) original type illustration is poor, her description suggests a close affinity with *Chrysalogonium* (Nodosariinae). Jones (1984) described the bilocular genus *Heteromorphina* (Glandulininae), suggesting that it may be the microspheric generation of *Oolina.* We do not include *Heteromorphina* in our classification due to the insufficient evidence in support of this hypothesis. Jones (1984) established the genus *Phialinea* Jones and the subfamily Phialineinae in the family (?)Eouvigerinidae Cushman. This genus, recorded by Jones (1984) as ranging from the Miocene to Holocene, was based on *Miliola elongata* Ehrenberg (1844; figured in Ehrenberg, 1854), an unrecognizable fragment from Cretaceous strata of western Syria. Ehrenberg (1844) gave the type locality as Kurdistan, whereas Ehrenberg (1854, pl. 25, la, fig. 1) listed the type locality of the species as Al Jabal Ash Sharqi (Anti-Lebanon) in western Syria. Jones placed *Parafissurina* and *Walterparria* Jones in the subfamily Parafissurininae Jones, in the Pleurostomellidae. He placed *Lagena* and *Pseudarcella* Spandel in the Lagenidae, in the order Incertae Sedis. *Pseudarcella* is, in fact, a tintinnid (Lindenberg, 1965; Tappan and Loeblich, 1968). Jones (1984) also assigned *Cribrolagena* Jones to the family Incertae Sedis, in the superfamily Nodosariacea.

EVOLUTIONARY HISTORY

The earliest record of lagenid foraminifers is from Lias of Germany (and elsewhere). Franke (1936) recorded Liassic species having generally circular axial sections, some possessing entosolenian tubes. He also reported a single species externally similar to *Fissurina.* By Early Cretaceous time, unilocular foraminifera were more diverse, although they still closely resembled Jurassic species (Parr, 1947). Haeusler (1887) figured compressed, carinate forms from the Neocomian of Switzerland that are similar to those found in modern oceans.

The phylogeny of unilocular foraminifera is primarily conjectural. Generally considered to have been derived from a multilocular ancestor, the number and identity of possible ancestors remains in question (Cushman, 1933; Glaessner, 1945). Loeblich and Tappan (1974) and Tappan (1976) suggested that they probably are derived from, or have a common ancestor with, the nodosariid lineage, which, in turn, probably arose from the nodosinellids of the Endothyracea. Jones (1984) postulated a polyphyletic origin for unilocular forms and placed them in the families Glandulinidae, Nodosariidae, Eouvigerinidae, Plectofrondicularüidae, Pleurostomellidae, and Lagenidae, on the basis of apertural position and configuration, and test shape. Jones (1984) recognized that evolutionary pathways are by no means proven, and that further work is required to discern phylogenetic trends. Rather than separating the unilocular foraminifera into more than one family based on conjecture, we reinstate the family Lagenidae Reuss to include all unilocular taxa, and recognize within it, three subfamilies. The first subfamily, Lageninae Reuss, includes *Lagena* and *Procerolagena* Puri, which lack an entosolenian tube. The second subfamily, Ellipsolageninae Silvestri, is composed of genera that have an entosolenian tube at some stage of the life cycle. We propose a new third subfamily, Sipholageninae, to include unilocular genera having double walls connected by a network of pillars.

TABLE 1. Percentage of *Lagenosolenia incomposita* Patterson and Pettis with entosolenian tube.

		Pliocene		Quaternary	
	Total	Timms Point	Italy	Rio Grande Rise	Benham Rise
Individuals	51	8	1	18	24
With tube (percent)	49	87.5	—	33.3	50
Without tube (percent)	51	12.5	100	66.7	50

CRITERIA FOR DISTINGUISHING GENERA

Despite the great species diversity seen in the studied samples and in the literature, some phenotypic groupings are recognizable. These groups are based on surface sculpture, test shape, wall structure, wall perforations, apertural configuration, and carinal development. We recognize 22 genera according to these criteria, including four new genera, four genera recognized by Loeblich and Tappan (1964), 13 described since 1964, and one reinstated from synonomy.

SIGNIFICANCE OF ENTOSOLENIAN TUBE

Live culture studies of *Glabratella* (Myers, 1940), *Tretomphalus* (Myers, 1943), *Rubratella* (Grell, 1958), and *Orbulina* (Le Calvez, 1936, 1947) have shown that some species (including unilocular forms), resorb internal calcareous structures during reproduction. In addition, Taylor and others (1985) found that of 185 megalospheric specimens of *Glandulina* from the Miocene of Austria, 183 had resorbed internal septae and lacked entosolenian tubes. Although the absence of a tube in some specimens may have been the result of damage, Taylor and others postulated that in most specimens it was related to a phase in the life cycle of the organism, perhaps reproduction. Our examination of specimens of *Lagenosolenia incomposita* Patterson and Pettis (1986) has yielded similar results (Table I). There are many difficulties associated with entosolenian tubes; they are almost invariably present in some species and occur sporadically in others, but because there are species in which tubes have never been found, these structures are biologically and taxonomically im-

portant, and must, therefore, be used in any realistic classification scheme.

TEST SHAPE

A wide spectrum of test shapes is found within the Lagenidae, and species have been grouped into several genera according to this important criterion. The variability includes globular or compressed tests, having or lacking a neck, with trigonal or tetragonal axial sections, or combinations of these. For example, *Lagenosolenia* McCulloch differs from *Fissurina* Reuss in having an elongate neck; *Pseudoolina* Jones is distinguished from *Fissurina* by having a spherical rather than compressed test; and *Procerolagena* is separated from *Lagena* because of its more elongate test.

WALL STRUCTURE

The Lagenidae have either single or double walls, and are further subdivided according to this criterion. Previously, only Moncharmont-Zei and Sgarrella (1977, 1978, 1980) have considered the wall structure of unilocular forms, and most species with double walls previously were placed in *Lagena.* We propose the new subfamily Sipholageninae to include those species with double walls.

WALL PERFORATIONS

The nature of perforations in the test wall has been an important criterion for generic determination in other foraminiferal groups, most notably planktonic taxa (Kennett and Srinivasan, 1983) and many agglutinated benthic taxa (Loeblich and Tappan, 1985). Many complex unilocular species are perforate or punctate, but some punctae do not completely penetrate the test surface. Hyaline species of *Fissurina* and *Parafissurina* in scanning electron micrographs (SEM) show no surface expression of punctae, although they are clearly visible from the test interior. *Cushmanina* Jones is readily distinguished by the presence of punctae immediately adjacent to or on the costae.

APERTURE

The character of the aperture traditionally has been an important diagnostic feature of the unilocular genera (Loeblich and Tappan, 1964). However, species with quite different apertural configurations were often lumped within the same genus (Buchner, 1940; Boltovskoy and Watanabe, 1977; and others). Those species with a slitlike aperture were assigned to *Fissurina,* those with a hooded aperture to *Parafissurina,* and those with a circular or radiate aperture to *Oolina.As* an example, species of *Pseudofissurina* were formerly placed in *Parafissurina* (Buchner, 1940) when, in fact, the aperture is a slit adjacent to an encircling carina, rather than below a hood.

CARINA

The carinate margin of compressed unilocular foraminifera varies from a simple marginal keel to highly complex, or even multiple carinae having tubules, struts, and (or) reticulations; we consider this significant in our generic designations. Species with simple carinae are referred either to *Lagenosolenia* or *Vasicostella,* n. gen., depending on their surface sculpture. Broadly carinate species are placed in *Wiesnerina* Jones or *Pseudofissurina* Jones, depending on the position of the aperture. Species with highly complex, tubulose carinae are placed in *Solenina* Jones.

METHODS OF ANALYSIS

Several thousand specimens from eighteen localities were studied under a binocular microscope. Both transmitted and reflected light were used to determine the morphologic characteristics, and the presence or absence of an entosolenian tube. Outer walls were partially removed from 40 specimens using the method described by Plummer (1951). Scanning electron micrographs were taken with an ISI Super 111A Scanning Electron Microscope, and Polaroid NP 55 film. Previously published illustrations are reproduced for formerly described species that we have designated as types of new genera.

MATERIALS

Specimens were studied from the following localities:

1. Quaternary: DSDP Site 357 (Leg 39) on the Rio Grande Rise, southwest Atlantic Ocean, lat. 30°00.25'5, long. 35°33.59'W. Core levels: 357-1-1, 82-92 cm; 357-1-2, 80-86 cm; 357-1-3, 80-86 cm; 357-1-4, 80-86 cm. Pliocene: 357-2-1, 80-86 cm; 357-2-4, 83-89 cm; 357-3-3, 80-86 cm; 357-5-3, 80-86 cm. Miocene: 357-7-5, 83-89 cm; 357-8-1, 83-89 cm; 357-8-5, 85-91 cm; 357-9-1, 75-81 cm; 357-10-3, 82-88 cm; 357-14-1, 80-86 cm; 357-14-CC. Oligocene: 357-16-1,74-80 cm; 357-17-1, 80-86 cm.

2. Quaternary: DSDP Site 292 (Leg 31) on the Benham Rise, western Philippine Basin, western Pacific Ocean, lat. 15°49.11'N, long. 124°39.05'E. Core levels: 292-1-1, 30-38cm; 292-1-2, 47-52 cm; 292-1-3, 27-33 cm; 292-1-4, 28-34 cm; 292-1-CC; 292-2-1, 120-126 cm; 292-2-2, 52-58 cm; 292-2-3, 34-39 cm; 292-2-CC; 292-3-1, 125-130 cm.

3. Quaternary: DSDP Site 207 (Leg 21) on the South Lord Howe Rise, Tasman Sea, lat. 36°57.75'S, long. 165°26.06'E. 207-1-2, 68-74 cm.

4. Pleistocene: Timms Point Formation, from railway cut behind parking lot at 1400 South Harbour Boulevard, San Pedro, California. Coil. by A. R. and H. T. Loeblich.

5. Lower Pliocene (Plaisancian): Ponticella di Savena, on right bank of stream below bridge near San Ruffillo, Province of Bologna, Italy. Coll. by B. Accordi, C. Loriga, and H. T. and A. R. Loeblich.

6. Upper Cretaceous: Bergstrom Formation (Taylor Group) on right (east) bank of Onion Creek, at Moore and Berry's Crossing, just downstream from iron bridges of Burleson Road, SE of Austin, Travis Co., Texas. CoIl. by A. R. and H. T. Loeblich, and B. Olszewska.

7. Holocene: Beach sand, Dogs Bay, 2 mi SW of Roundstone Village, County Mayo, Ireland.

8. Holocene: F. C. *Goldseeker,* Haul 127, Entrance to Stornoway Harbor, 37-66 m, August 15, 1907.

9. Holocene: F. C. *Goldseeker,* Haul 175, E. Loch Roag, Lewis, 9-13 m, August 29,1908.

10. Holocene: F. C. *Goldseeker,* Haul 70, In Cromarty Firth, 18 m, March 8, 1907.

11. Holocene: F. C. *Goldseeker,* Haul 228, W Atlantic to N of St. Kilda, Iat. 57°59'N, long. 10°34'W, October 28, 1910.

12. Holocene: F. C. *Goldseeker,* Haul 102, 3 1/2 miles W of Cava Island, Scapa Flow, Orkney, 38 m, July 15, 1907.

13. Holocene: F. C. *Goldseeker,* Dogger Bank, 52 m, lat. 54°55'N, long. 0°42'E, September 16,1913.

14. Holocene: F. C. *Goldseeker*, Haul 11159, Station 15 B, 282 m, lat. 61°39'N, long. 4°45'W, June 21,1909.
15. Holocene: F. C. *Goldseeker*, Haul 188, Kinnaird Deep, Moray Firth, 196 m, June 28, 1909.
16. Holocene: Scripps Institution of Oceanography, 1961 Sahul Shelf Cruise 2 of *Stranger*, Core V-227, lat. 11°59.2'S, long. 123°53.3'E, 94 m, Timor Sea.
17. Holocene: Scripps Institution of Oceanography, 1960 Sahul Shelf Cruise I of the *Malita*, Core V-27, lat. 9°46.0'S, long. 128°21.5'E, 89 m, Timor Sea.
18. Holocene: Scripps Institution of Oceanography, 1961 Sahul Shelf Cruise 2, of the *Stranger*, Core V-224, lat. 12°14.0'S, long. 124°23.0'E, 96 m, Timor Sea, off NW Australia.

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SYSTEMATIC DESCRIPTIONS

Referral of established species to new genera is based on examination of hypotypes or topotypes or on a literature search. These species listings are not complete but are provided to indicate the morphologic variability within the genera cited. Holotypes, figured paratypes, unfigured paratypes and hypotype s of formerly described species are deposited in the National Museum of Natural History, Washington, D.C.

Suborder LAGENINA Delage and Herouard, 1896
Superfamily NODOSARIACEA Ehrenberg, 1838
Family LAGENIDAE Reuss, 1862

Test unilocular, wall with one or two layers, aperture circular, ovate, slitlike or radiate, centric or excentric, entosolenian tube present or absent.

Subfamily LAGENINAE Reuss, 1862

Lageninae REUSS, 1862, p. 305.
Phialiniinae JONES 1984, p. 125.

Test unilocular, aperture circular, no entosolenian tube, wall with a single layer of calcite.

Lagena Walker and Jacob, 1798

Lagena WALKER and JACOB, *in* Kanmacher, 1798, p. 634.
Serpula (Lagena) BOYS and WALKER, 1784, (publ. rejected, ICZN Op. 558, 1959).
Vermiculum MONTAGU, 1803, p. 517.
Lagenula DE MONTFORT, 1808, p. 311.
Tetragonufina SEGUENZA, 1862, p. 53.
Capitellina MARSSON, 1878, p. 122.
Ectolagena SILVESTRI, 1900, p. 4.

Type species. Serpula (Lagena) sulcata Walker and Jacob, *in* Kanmacher, 1798, p. 634, pl. 14, fig. 5; subsequently designated by Parker and Jones, 1859, p. 337.

Diagnosis. A genus of Lageninae whose species have a globular, costate test, and a perforate wall.

Range. Jurassic to Holocene (from the literature).

Remarks. Lagena differs from *Proceroiagena* in being globular rather than fusiform.

Procerolagena Puri, 1954

Procerolagena PURl, 1954, p. 104.
Phialinea JONES, 1984. p. 125.

Type species. Lagena gracilis Williamson, 1848, p. 13, pl. 1, fig. 5; by original designation.

Diagnosis. A genus of Lageninae whose species have an elongate, fusiform test, longitudinal costae, and an imperforate wall.

Range. Paleocene to Holocene (from the literature).

Remarks. Procerolagena differs from *Lagena* in having an elongate rather than globular test, and from *Hyalinonetrion* in having longitudinal costae.

Subfamily ELLIPSOLAGENINAE Silvestri, 1923

Ellipsolageninae SILVESTRI, 1923, p. 265.
Oolininae LOEBLICH and TAPPAN, 1961, p. 299.
Reussoolininae JONES, 1984, p. 94.

Test unilocular, aperture circular, ovate, slitlike or radiate, centric or excentric; entosolenian tube present; wall with single layer of calcite.

OoUna d'Orbigny, 1839

Oolina D'ORBIGNY, 1839, p. 18.
Ovulina EHRENBERG, 1845, p. 357.
Cenchridium EHRENBERG, 1845, p, 357.
Entosolenia WILLIAMSON, 1848, p. 16.
Obliquina SEGUENZA, 1862, p. 75.
Lagenulina TERQUEM, 1876, p. 67.
Entolagena SIL VERSTRI, 1900, p. 4.
Lagena (Reussoolina) COLOM, 1956, p. 71.
Anturina JONES, 1984, p. 99.
Reussoolina Colom.-JONES, 1984, p. 94.

Type species. Oolina laevigata d'Orbigny, 1839, p. 19, pl. 5, fig. 3; subsequently designated by Galloway and Wissler, 1927, p. 50.

Diagnosis. A genus of Ellipsolageninae whose species have a smooth, globular test, circular or radiate aperture, a finely perforate wall, and no neck.

Range. Jurassic to Holocene.

Remarks. Jones (1984) erected the subfamily Reussoolininae Jones within the Nodosariidae, and reinstated the genus *Reussoolina* Col. om to include those species with radiate apertures and no entosolenian tube. He placed those unilocular taxa with a radiate aperture and an entosolenian tube in the genus *Anturina* (Anturininae, Jones). However, Norling (1972) showed that in certain species of *Nodosaria* the apertural shape grades from circular to radiate. We follow Loeblich and Tappan (1964) and do not consider possession of a radiate aperture to be a valid criterion for separating *Oolina* from other genera.

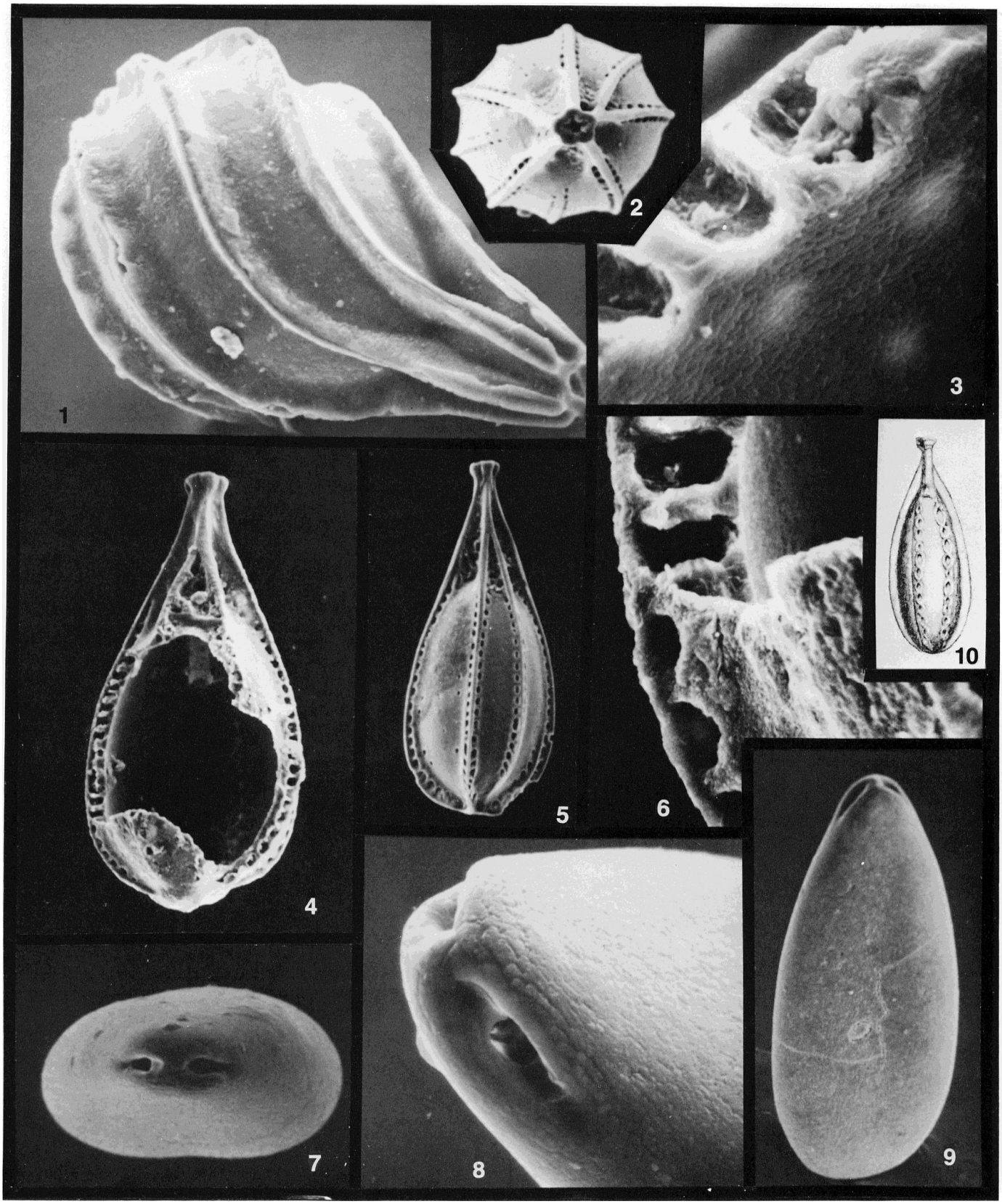

PLATE I

1 *Cushmanina tasmaniae* (Quilty). Core V-27, 1960 Sahul Shelf Cruise I, Timor Sea, Holocene. Side view of hypo type (USNM 383360), x 700. 2-6 *Cushmanina striatopunctata* (Parker and Jones). Timms Point Formation, California, Pleistocene. 2 apertural view of hypotype (USNM 383355) showing radiate aperture, x 300; 3 enlargement of imperforate inner surface of wall with light spots denoting thin walled areas beneath outer punctae, x 5,000; 4 side view of broken specimen showing short, straight entosolenian tube, x 300; 5 side view showing

Cushmanina Jones, 1984

Pl. 1, Figs. 1-6, 10

Cushmanina JONES, 1984, p. 105.

Type species. Lagena vulgaris Williamson var. *desmophora* F. W. O. R. Jones, 1874 (part), p. 54, pl. 19, fig. 24 (not fig. 23); figure 24 designated herein as lectotype.

Diagnosis. A genus of Ellipsolageninae in which species have globular to ovate tests with a row of punctae (which may or may not completely penetrate the test wall) within or adjacent to longitudinal costae; aperture terminal to elongate neck, radiate, with a phialine lip.

Range. Upper Eocene to Holocene (from the literature).

Remarks. Cushmanina differs from *Lagena,* and *Procerolagena* in having punctae associated with the longitudinal costae. Specimens of *Cushmanina* commonly lack an entosolenian tube. Jones (I984) defined the genus as having a globose form, a rounded aperture, and lacking a multicarinate test. We consider the punctae associated with the longitudinal costae to be the primary distinguishing character.

Cushmanina striatopunctata (Parker and Jones)

Pl. 1, Figs. 2-6

Lagena sulcata Williamson var. *striatopunctata* PARKER and JONES, 1865, p. 350, pI. 13, figs. 25-27.

Types and occurrence. Pleistocene, Timms Point Formation. Figured hypotypes (USNM Nos. 383355, 383356) from railway cut behind 1400 S. Harbour Blvd., San Pedro, California.

Cushmanina tasmaniae (Quilty)

Pl. 1, Fig. 1

Lagena tasmaniae QUILTY, 1974, p. 70, pl. 3, fig. 107.

Types and occurrence. Pleistocene, Timms Point Formation. Figured hypotype (USNM 383360) from railway cut behind 1400 S. Harbour Blvd., San Pedro, California.

Duplella, n. gen.

Pl. 1, Figs. 7-9; Pl. 5, Figs. 1, 2

Type species. Duplella apexadina, n. sp.

Diagnosis. A genus of Ellipsolageninae containing compressed, ovate species with a divided aperture.

Description. Test free, unilocular, elongate, broadest near base, compressed, oval in axial section; wall calcareous, translucent, smooth, imperforate; aperture two oblong openings separated by apical partition, entosolenian tube short and straight.

Etymology. From the Latin, *duplus,* two-fold; *+-ella,* diminutive; with reference to the double aperture. Gender, feminine.

Range. Pleistocene to Holocene.

Material. 2 specimens of the type (and only) species.

Remarks. Duplella is differentiated from *Fissurina* by having a double rather than single aperture. It differs from *parafissurina* in lacking an aboral apertural hood over a single aperture.

Duplella apexadina, n. sp.

Pl. 1, Figs. 7-9; Pl. 5, Figs. 1,2

Diagnosis. A species of *Duplella* with an elongate, smooth test, and a short, straight entosolenian tube.

Description. Test free, unilocular, elongate, broadest near base, compressed, ovate in axial section; wall calcareous, hyaline, smooth; entosolenian tube short and straight.

Etymology. From the Latin, *apexados,* a sausage; *+-ina,* diminutive; with reference to the elongate test.

Dimensions. Maximum length, 215 *I-Lm;* maximum width, 100 .m.

Material. 2 specimens.

Types and occurrence. Quaternary. Ho1otype (USNM 383327) and unfigured paratype (USNM 383362) from DSDP Site 357 (Leg 39), Rio Grand Rise, southwest Atlantic Ocean, lat. 30°00.25'S, long. 35°33.59'W, 357-1-1, 80-86 cm.

Remarks. Duplella apexadina is differentiated from *Fissurina cochensis* McCulloch by the presence ofa marginal band and fissurine aperture. The species is differentiated from *Lagena compressa* Egger, by its divided aperture.

Fissurina Reuss, 1850

Fissurina REUSS, 1850, p. 366.
Hyaleina COSTA, 1856, p. 366.
Ellipsolagena SILVESTRI, 1923, p. 265.
Ellipsofissurina SILVESTRI, 1923, p. 265.

Type species. Fissurina laevigata Reuss, 1850, p. 1049, pl. 86, fig. 3; original designation by monotypy.

Diagnosis. A genus of Ellipsolageninae whose species have a compressed test, perforate wall, circular, ovate, or slitlike aperture in the center of a fissurelike cavity at test apex, and no neck.

Range. Cretaceous to Holocene (from the literature).

Remarks. Fissurina differs from *Pseudoolina* Jones in being compressed rather than globular, and from *Pseudofissurina* Jones in lacking a carina.

Galwayella Patterson and Pettis, 1986

Trigonulina SEGUENZA, 1862, p. 74 (not d'Orbigny, 1846).
Galwayella PATTERSON and PETTIS, 1986, p. 74, pl.1, figs. 1-4.

Type species. Lagena trigonoelliptica Balkwill and Milleu, 1884, p. 81, pl. 3, fig. 8.

Diagnosis. A genus of Ellipsolageninae whose species have tests with a distinct, trigonal axial section.

Range. Miocene to Holocene.

Irenita Jones, 1984

lrenita JONES, 1984, p. 116.

Type species. Lagena cornigera Buchner, 1940, p. 514, pl. 22, figs. 445-450.

Diagnosis. A genus of Ellipsolageninae whose species have compressed, carinate tests and produced, crescentic apertures.

Range. Pleistocene to Holocene (from the literature).

Lagenosolenia McCulloch, 1977

Lagenosolenia MCCULLOCH, 1977, p. 49.
Buchnerina JONES, 1984, p. 104.

Type species. Lagenosolenia soulei McCulloch, 1977, p. 49, pl. 52, figs. 1,4; by original designation.

Diagnosis. A genus of Ellipsolageninae whose species have a smooth, imperforate wall, a circular to ovate aperture terminal to a neck, and may be carinate.

Range. Oligocene to Holocene.

Remarks. Lagenosolenia differs from *Vasicostella,* n. gen, and from *Solenina* in having a smooth test. When present, carinae are comparatively simple. Jones (1984) described *Buchnerina* to differentiate those forms of *Lagenosolenia* with circular apertures. Our studies of *Lagenosolenia* have shown a gradation of apertural shape from circular, to ovate, to fissurine.

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double row of punctae along each costa, x 200; 6 cross-section of costa showing punctae nearly penetrating inner surface of wall, x 2,000. 7-9 *Duplella apexadina,* n. sp. DSDP Site 357, Quaternary. 7 apertural view of holotype (USNM 383327) showing divided aperture and ovate outline, x 600; 8 oblique view showing divided aperture, xl ,500; 9 side view showing smooth surface and pyriform shape, x 350. 10 *Cushmanina desmophora* (Jones). Sounding No.2, H.M.S. *Serpent* lat. 8°30'S, long. 115°10'E, Java Sea, Holocene. Illustration from Jones, (1874, pl. 19, fig. 24), x 200.

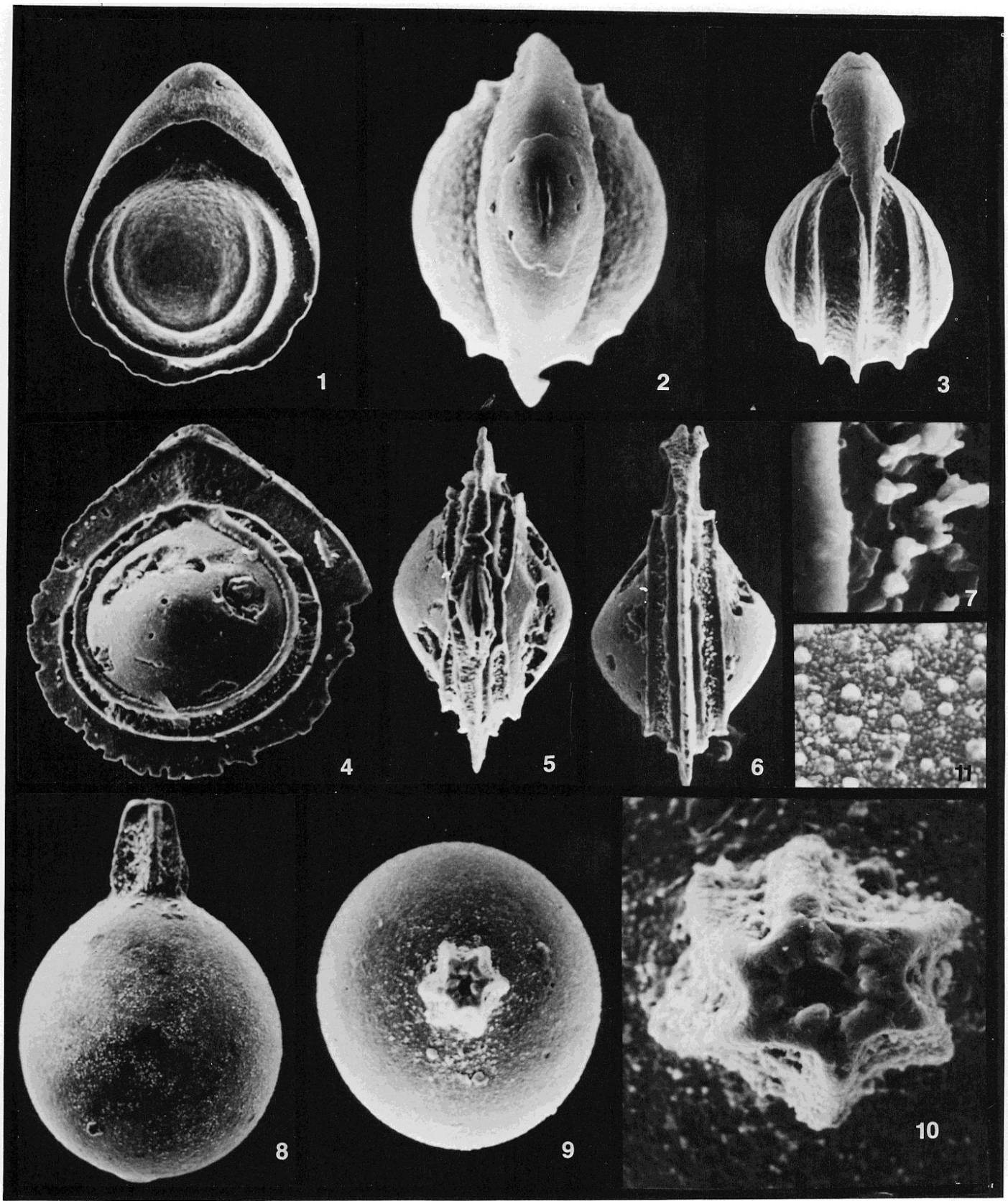

PLATE 2

1-3 *Palliolatella pallialata* (Earland). DSDP Site 357, Quaternary. **1** side view of hypo type (USNM383570) showing carina thickening to hoodlike structure enclosing neck, x 200; **2** apertural view showing nssurine slit, x 300; **3** edge view, showing thickened principal carina and supplementary carinae, x 200. 4-7 *Pal/iolatella avila,* n. sp. Bergstrom Formation (Taylor Group), Texas, Upper Cretaceous. **4** side view of

Palliolatella, n. gen.

Pl. 2, Figs. 1-7; Pl. 5, Figs. 3-6

Type species. Palliolatella avila, n. sp.

Diagnosis. A genus of Ellipsolageninae whose species have compressed tests with the upper portion of the neck and aperture enclosed by an inflated carina.

Description. Test free, unilocular, elongate, carinate, compressed; wall calcareous, hyaline to translucent, imperforate; carina widens toward aperture forming hood that encloses upper portion of neck; aperture fissurine with entosolenian tube.

Etymology. From the Latin, *palliolatus*, covered with a hood; *+-ella*, diminutive; with reference to the inflated carina. Gender, feminine.

Range. Upper Cretaceous to Holocene.

Material. 25 specimens of the type species; 45 specimens of *P. pallioiata* (Earland).

Remarks. Pailialatelia differs from *Lagenosolenia, Vasicostella,* and *Solenina* in possessing an inflated hoodlike carina enclosing the upper portion of the neck.

Based on the examination of 45 specimens, we place *Lagena palliolata* Earland in *Pailloiatella.* Following a literature search, we transfer *L. orbignyana* (Seguenza) var. *pileata* Matthes, *L. orbignyana* (Seguenza) var. *rhumbleri* Buchner, *L. orbignyana* (Seguenza) var. *unicoslata* Sidebottom, and *Lagenosolenia coronatiformis* McCulloch, to *Pailiolatella.*

Palliolatella avita, n. sp.

Pl. 2, Figs. 4-7; Pl. 5, Figs. 3, 4

Entosoienia orbignyana (Seguenza) CUSHMAN, 1946 (part), pl. 52, figs. 17, 18, (not fig. 16) (not Seguenza, 1862).

Diagnosis. A species of *Palliolatella* with a granular band between carinae encircling the test.

Description. Test free, unilocular, compressed, ovate in axial section, completely encircled by principal carina; two smaller secondary carinae surround margin of test on each side of principal carina, and enclose narrow band of granular material; wall calcareous, hyaline, smooth, imperforate; aperture a narrow slit at center of hoodlike flange; entosolenian tube short, straight.

Etymology. From the Latin, *avitus*, ancient; with reference to the Cretaceous age of the species.

Dimensions. Maximum length, 250 , µm; maximum width 225 , µm.

Material. 25 specimens.

Types and occurrence. Upper Cretaceous. Holotype (USNM 383350), figured paratype (USNM 383351), and unfigured paratypes (USNM 383354) from the Bergstrom Formation (Taylor Group) on right (east) bank of Onion Creek, at Moore and Berry's Crossing, just downstream from iron bridge of Burleson Road, SE of Austin, Travis Co., Texas.

Remarks. Cushman (1946) referred this species to *Entosolenia orbignyana* (Seguenza) which lacks the coarse bands of granular material found in *Palliolatella avita.* Although *P. avita* has an aperture similar to that of *Lagena orbignyana* Seguenza var. *cora nata* Sidebottom, it has more carinae, and lacks the broad opaque band encircling each side of the test.

Palliolatella palliolata (Earland)

Pl. 2, Figs. 1-3; Pl. 5, Figs. 5, 6

Lagenapalliolata EARLAND, 1934, p. 158, pl. 7, figs. 5, 6.
Lagenosolenia palliata MCCULLOCH, 1977, p. 67, pl. 61, fig. 21.

Types and occurrence. Quaternary. Figured hypo type (USNM 383570) from DSDP Site 357 (Leg 39), on the Rio Grande Rise, southwest Atlantic Ocean, lat. 30°00.25'5, long. 35°33.59'W, 357-1-2,80-86cm.

Parafissurina Parr, 1947

Parafissurina PARR, 1947, p. 123.

Type species. Lagena ventricosa Silvestri, 1904, p. 11, text fig. 6; by original designation.

Diagnosis. A genus of Ellipsolageninae whose species have compressed tests, with porous walls, and an aperture within a hoodlike extension on one wall.

Range. Middle Eocene to Holocene (from the literature).

Pristinosceptrella, n. gen.

Pl. 2, Figs. 8-11; Pl. 5, Fig. 7

Type species. Pristinosceptrella hispida, n. sp.

Diagnosis. A genus of Ellipsolageninae whose species have tests with a distinct neck and a hispid surface.

Description. Test free, unilocular, subspherical; wall calcareous, translucent, moderately perforate, hispid; neck narrow, distinct, may be costate or hispid; aperture circular or radiate, with entosolenian tube.

Etymology. From the Latin, *pristinus.* early, primitive; + *sceptrum*, scepter + *-effa*, diminutive; with reference to the spherical, slender neck. Gender, feminine.

Range. Miocene to Holocene.

Material. 5 specimens of the type species.

Remarks. Pristinosceptrella differs from *Oolina* in having a more distinctive neck and a hispid surface. *Pristinosceptrella* differs from *Lagena* in having an entosolenian tube, and from *Lagenosolenia* McCulloch and *Fissurina* Reuss in not being compressed. *Pristinosceptrella* differs from *Pseudooiina* in having a circular or radiate, rather than fissurine, aperture.

Pristinosceptrella hispida, n. sp.

Pl. 2, Figs. 8-11; Pl. 5, Fig. 7

Oolina sp. 2.-JONES, 1984, p. 104, pl. 1, fig. 27.

Diagnosis. A species of *Pristinosceptreila* with the entosolenian tube attached at the base of the test.

Description. Test free, unilocular, subspherical, with a short, relatively thick neck; wall calcareous, hyaline, perforate; test hispid with finely granular groundmass; neck short, hispid, with 6 stout, longitudinal ribs; an array of long calcite projections in depressions between costae; a series of comparatively large pits devoid of ornamentation along the longitudinal depressions; aperture small, ra. diate, entosolenian tube slightly bowed and attached at base of test, marked by slight bulge.

Etymology. From the Latin, *hispidus*, hairy, bristly, rough; with reference to the test surface.

Dimensions. Maximum length, 300 ,µm; maximum width, 200 µm.

Material. 5 specimens.

Types and occurrence. Quaternary. Holotype (USNM 383326) from DSDP Site 357 (Leg 39), Rio Grande Rise, southwest Atlantic Ocean, lat. 30°OO.25'S, long. 35°33.59'W, 357-1-2, 80-86 cm.

Pseudofissurina Jones, 1984

Pseudofissurina JONES, 1984, p. 118.

Type species. Pseudofissurina mccuilochaeJones, 1984, p. 119, pl. 4, figs. 16-18.

Diagnosis. A genus of Ellipsolageninae whose species have tests with the aperture enclosed in the side of a peripheral carina.

Range. Miocene to Holocene.

Remarks. Pseudofissurina differs from *Fissurina* in not having its aperture at the center of a fissurelike cavity, and from *Parafissurina* in lacking a globular test and hooded aperture. Although one margin

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holotype (USNM 383350) showing slightly developed hood partially enveloping neck, 2 secondary carinae along inner margin of principal carina, x 300; **5** apertural view showing fissurine slit, x 300; **6** edge view showing carinal development and distinctive surface granulation between primary and secondary carinae, x 300; **7** enlargement showing distinctive granular surface between carinae, x 3,000. **8-11** *Prislinosceptrella hispida.* n. sp. DSDP Site 357, Quaternary. 8 side view ofholotype (USNM 383326) showing subspherical, hispid test and coarsely costate neck, x 240; **9** apertural view showing radiate aperture, x300; **10** enlargement of radiate aperture, x 1,000; **11** enlargement of outer surface of test wall showing variable hispidity, x 3,000

of the test adjacent to the aperture is elevated in *pseudofissurina,* this slit arrangement is not similar, with respect to the aperturallip, to the overhanging hood of *Parafissurina.*

Pseudoolina Jones, 1984

Pseudoolina JONES, 1984, *p.* 119.

Type species. Pseudoolina fissurinea Jones, 1984, p. 119, pl. 4, figs. 19,20.

Diagnosis. A genus of Ellipsolageninae whose species hae a globular test and a fissurine aperture.

Range. Miocene to Holocene.

Remarks. We place *Oolina(?)* cf. *O. giobosa* (Montagu), as figured by McCulloch (1977, pI. 56, fig. 13), in *Pseudoolina.*

Pseudosolenina Jones, 1984

Pseudosolenina JONES, 1984, p. 120.

Type species. Pseudosolenina borealis JONES, 1984, p. *120,* pl. 4, figs. 25, 26.

Diagnosis. A genus of Ellipsolageninae whose species have com. pressed, keeled tests, with a neck and a subterminal crescentic aperture between unequally developed lips.

Range. Pleistocene to Holocene (from the literature).

Solenina Jones, 1984

Pl. 3, Figs. 1-9; Pl. 5, Figs. 8-10

Solenina JONES, 1984, p. 121.

Type species. Lagenosolenia(?) tenuistriatijormis McCulloch, 1977, p. 74, pl. 51, fig. 7.

Diagnosis. A genus of Ellipsolageninae whose species have compressed tests, with a neck and a complex carinate margin.

Description. Test free, unilocular, compressed, flask-shaped, with a partial or complete carinate margin; wall calcareous, perforate; surface variously sculpted; carinate margin with tubules, struts or other complex structures; aperture radiate, with or without phialine lip.

Range. Miocene to Holocene.

Remarks. Jones (1984) defined *Solenina* on the basis of its elongate neck, and mentioned the presence of tubules in the carina. We consider these tubules to be the primary distinguishing character of the genus.

We transfer several species formerly included in *Entosolenia, Lagenosolenia, Fissurina,* and *Lagena* to *Solenina.* These include *Entosolenia sigmoidella* (Cushman) var. *timmsensis* Cushman and Gray, and *Fissurina pacifica* Parr, based on examination of specimens. *Fissurina subformosa* Parr, *Lagenosolenia bilagenoides* McCulloch, *L. wenmanensis* McCulloch, and *Lagena formosa* Schwager are transferred to the genus based on the literature.

Solenina timmsensis (Cushman and Gray)

Pl. 3, Figs. 4-9; Pl. 5, Fig. 8

Entosolenia sigmoidella (Cushman) var. *timmsensis* CUSHMAN and GRAY, 1946, p. 30, pl. 5, figs. 34-36.

Lagenosolenia sigmoidella timmsensis (Cushman).-MCCULLOCH, 1977, p. 72, pl. 51, figs. 10-14.

Types and occurrence. Pleistocene, Timms Point Formation. Figured topotype (USNM 383344) from railway cut behind 1400 S. Harbour Blvd., San Pedro, California.

Vasicostella, n. gen.

Pl. 4, Figs. 1-8; Pl. 5, Figs. 11, 12

Type species. Lagena vulgaris var. *helophoromarginata* F. W. O. R. Jones, 1874, p. 61, pl. 19, fig. 48.

Diagnosis. A genus of Ellipsolageninae whose species have a compressed test, a neck, surface sculpture, and lateral carina lacking tubules or complex structures.

Description. Test free, unilocular, compressed, flask-shaped, partially or completely carinate; wall calcareous, perforate; surface variously sculpted; aperture circular to ovate, with or without a phialine lip; entosolenian tube present.

Etymology. From the Latin, vas, vassis, vessel, duct; + costa,rib, side, ridge; + *-ella,* diminutive; with reference to the sculpted surface of the test. Gender, feminine.

Range. Pleistocene to Holocene.

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PLATE 3

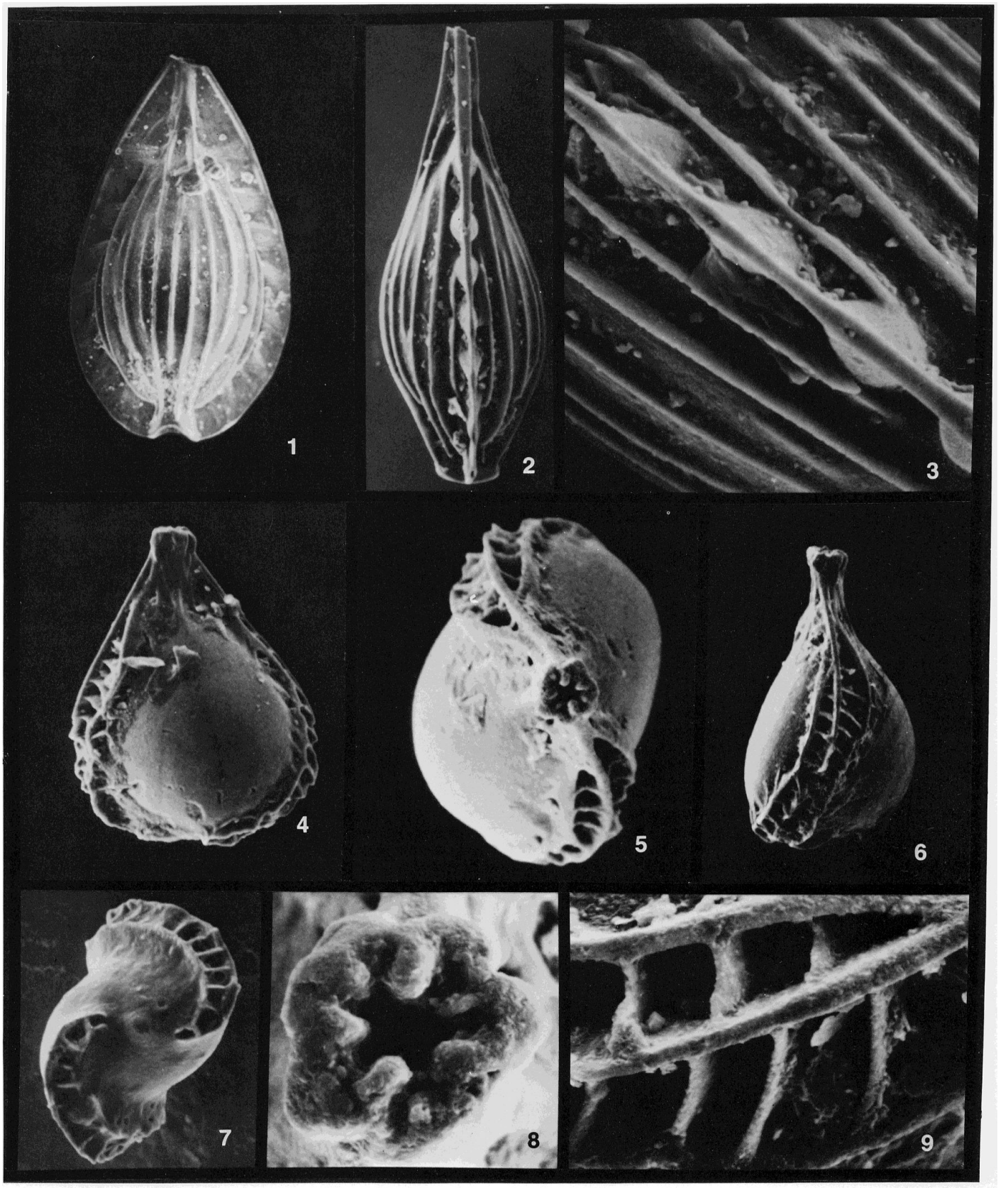
1-3 *Solenina tenuistrialljormis* (McCulloch). DSDP Site 292, Quaternary. **1** side view of hypo type (USNM 383343) showing surface costae and lateral swelling of the carina, x 300; **2** edge view showing compressed outline, x 240; **3** enlarged edge view of carina showing small opening at the termination of each lateral tubulation within carina, x 1,000. **4-9** *Solenina timmsensis* (Cushman and Gray). Timms Point Formation, California, Pleistocene. **4** side view of to po type (USNM 383344) showing network of cross struts separating twisted triple carinae, x300; **5** apertural view showing radiating slits and twisted triple carinae, x 500; **6** edge view showing cross struts and triple carinae, x 300; **7** basal view of a second topotype (USNM 383344), showing cross struts and sigmoidal double carinae, x 300; **8** enlargement of radiate aperture seen in Figure 5, x 2,000; **9** enlargement of triple carinae (seen in Figure 6) showing cross struts, x 1,500.

PLATE 4

1-4 *Vasicostella helophoromarginata* (F. W. O. R. Jones). DSDP Site 292, Quaternary. **1** side view of hypo type (USNM 383357) showing characteristic surface texture and simple carina and 2 short lateral costae on neck, x 300; **2** edge view showing compressed test, x 300; **3** apertural view showing ovate opening, x500; **4** enlargement of ovate aperture, x 2,000. **5-8** *Vasicostella singulara,* n. sp. DSDP Site 357, Quaternary. **5** side view of para type showing distribution of carina and costae (USNM 383572), x200. **6** apertural view of holotype (USNM 383571) showing ovate opening, carina and costae, x 200; **7** edge view, showing compressed test, carina and costae, x 200; **8** side view showing carina and costa, x200. **9-11** *Wiesnerina carinala* S. H. Taylor, n. sp. DSDP Site 207, Quaternary. **9** side view of holotype (USNM 383359) showing broad carina and slitlike aperture at junction of carina and test, x 120; **10** oblique view showing aperture at juncture of carina and test, x 200; **11** edge view showing compressed test and broad, thin carina, x 200.

PLATE 5

Schematic drawings of specimens showing the position of entosolenian tubes. **1, 2** *Duplella apexadina,* n. sp., showing short, straight, entosolenian tube. Same specimen as Pl. 1, Fig. 9, x250. **3, 4** *Palliolatella avila,* n. sp., showing short, straight entosolenian tube. Same specimen as Pl. 2, Figs. 4, 6, x 215. **5, 6** *Palliolatella palliolala* (Earland), showing short, straight entosolenian tube. USNM 383348, DSDP Site 292-2-CC, x 170. **7** *Prislinosceptrella hispida,* n. sp., showing slightly bent entosolenian tube terminating at base. Same specimen as Pl. 2, Fig. 8, x 168. 8 *Solenina timmsensis* (Cushman and Gray), showing short, straight entosolenian tube. Same specimen as PI. 3, Fig. 4, x 213. **9, 10** *Solenina lenuislrialiformis* Jones, showing short, straight entosolenian tube. Same specimen as Pl. 3, Figs. 1,2, x 207. **11, 12** *Vasicoslella helophoromarginala* (Jones), showing short, straight entosolenian tube. Same specimen as Pl. 4, Figs. 1,2, x214. 13 *Wiesnerina carinata* Taylor, n. sp., showing entosolenian tube attached to back wall and terminating at base. Same specimen as Pl. 4, Fig. II, x 147.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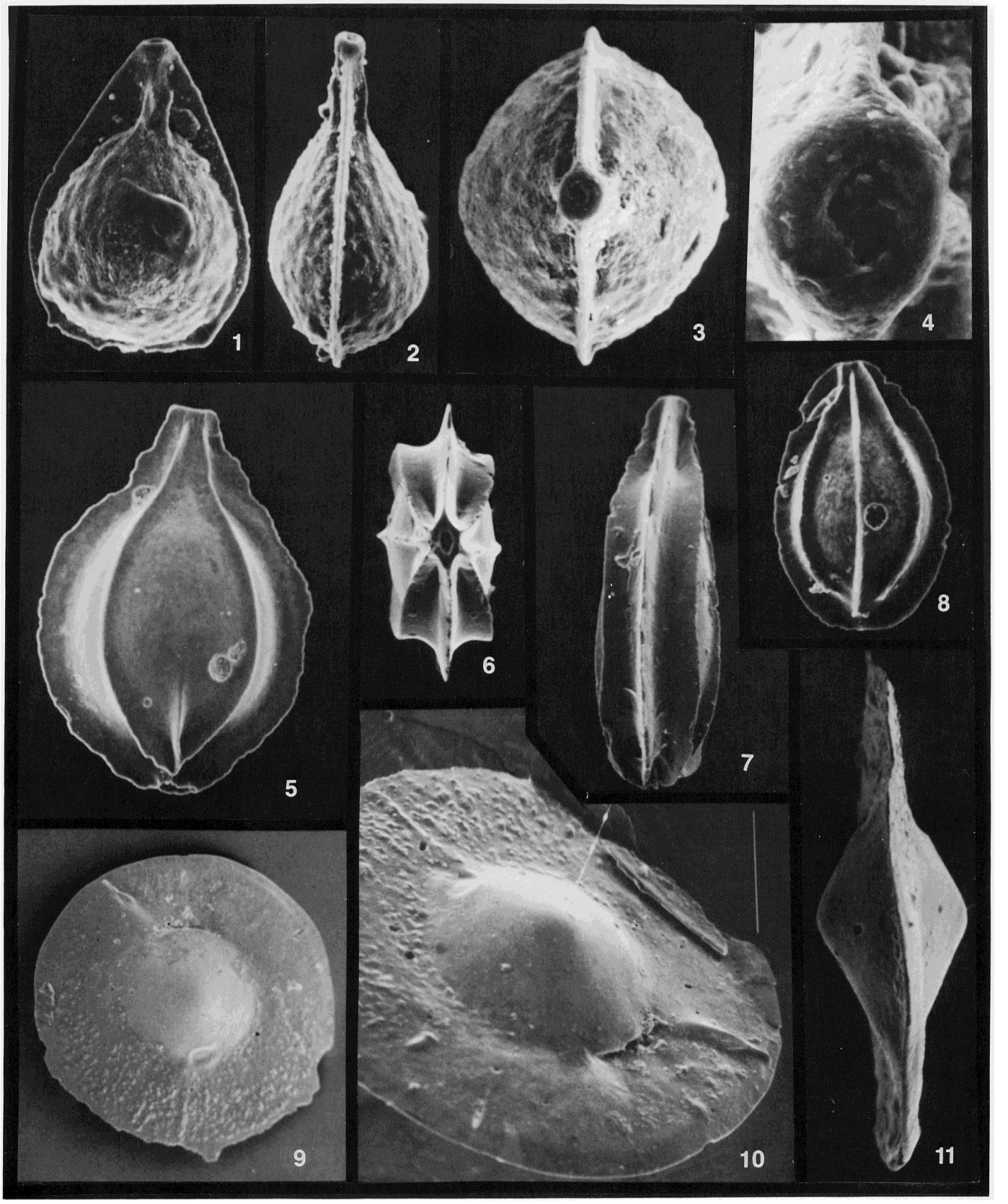
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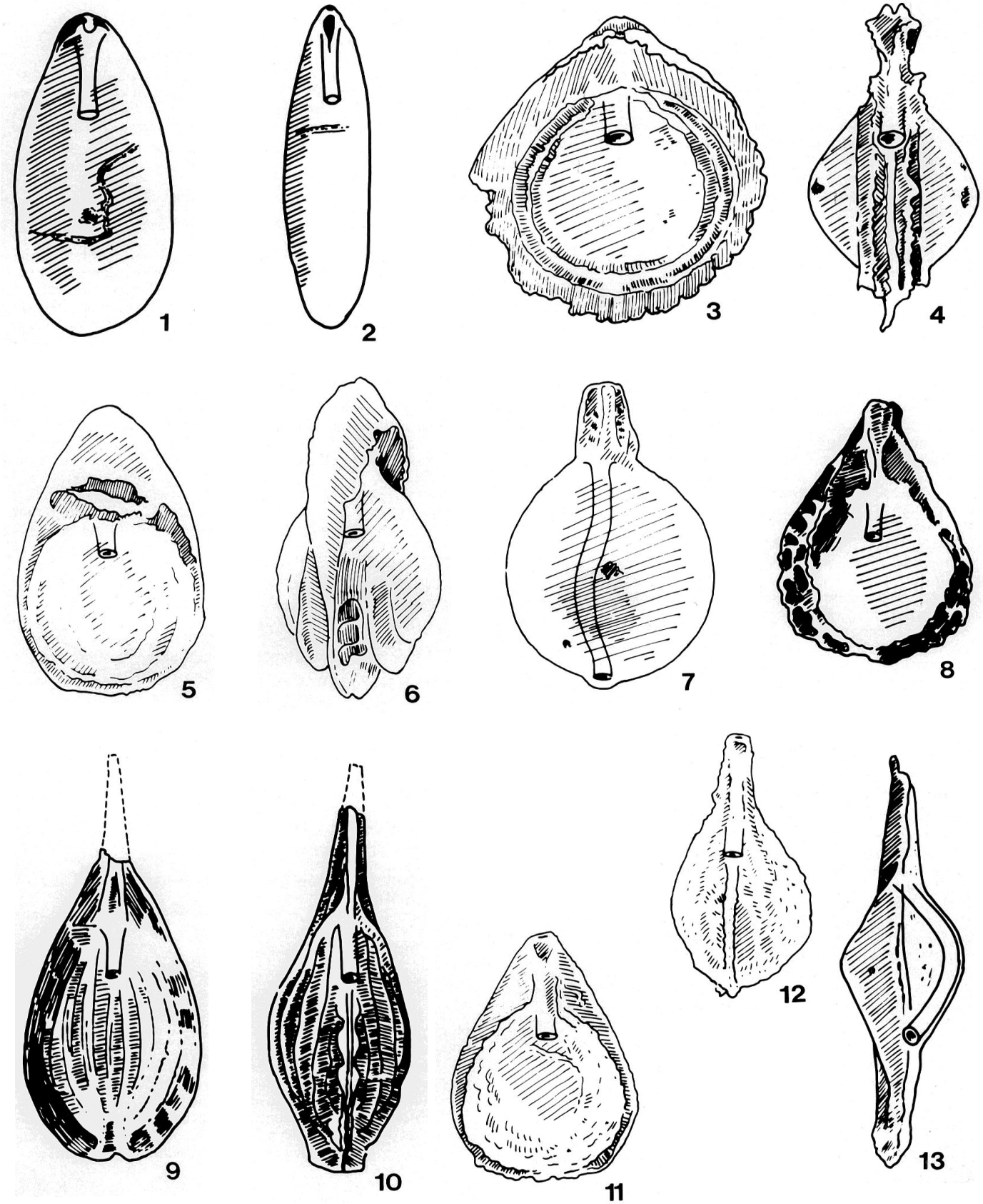
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Material. 2 specimens of the type species and 5 specimens of *V. singulara*, n. sp.

Types and occurrence. Quaternary. Figured hypotype (USNM 383357) from DSDP Site 292 (Leg 31), Benham Rise, western Philippine Basin, western Pacific Ocean, lat. 15°49.11'N, long. 124°39.05'E, 292-2-CC.

Remarks. Vasicostella differs from *Lagenosolenia* in having surface sculpture, and from *So/enina* in lacking a complex carina.

Following our examination of two specimens of *Lagena vulgaris* Williamson var. *helophoromarginata* Jones, we herein transfer it to *Vasicostella* as the type species. Based on a literature search, we place *Lagenoso!enia prolatiperforata* McCulloch, *L. parvula* McCulloch, *Fissurina neocastrensis* McCulloch, and *Lagena gratiosa* Buchner in *Vasicostella.*

Vasicostella singulara, n. sp.
Pl. 4, Figs. 5-8

Diagnosis. A species of *Vasicostella* with a longitudinal costa partly or completely bisecting each side of test.

Description. Test free, unilocular, elongate, compressed; wall calcareous, translucent, pores do not completely penetrate wall; thin sharp-edged carina completely encircles test terminating at aperture; this principal carina flanked by pair of secondary carinae that extends down each side oftest; secondary carinae form a subacute projection at the base, which may unite with principal carina; an additional single, median, longitudinal costa may extend from base of test to just below aperture, or may terminate a short distance from base; aperture terminal, small, ovate.

Types and occurrence. Holotype (USNM 383571), figured paratype (USNM 383572), and unfigured paratype (USNM 383573) from DSDP Site 357 (Leg 39), on the Rio Grande Rise, southwest Atlantic Ocean, lat. 30°00.11'S, long. 35°33.59'W, 357-1-1, 82-92 cm.

Dimensions. Maximum length, 360 µm; maximum width, 250 µm.

Etymlogy. From the Latin, *singulus*, one, *singularis*, alone, single, with reference to the single longitudinal costae.

Material. 5 specimens.

Remarks. Vasicostella singulara is distinguished from *Palliolatella orbignyana* (Seguenza) *unicostata* (Sidebottom) by lacking the inflated apertural carina. In addition, the single longitudinal costa of *P. orbignyana unicostata* is isolated from both the aperture and the test base.

Ventrostoma Schnitker, 1970

Ventrostoma SCHNITKER, 1970, p. 46.
Arthurina JONES, 1984,p. 104.

Type species. Lagena fovigera Buchner, 1940, pl. 14, figs, 627-629; by original designation.

Diagnosis. A genus of Ellipsolageninae whose species have tests with the aperture separated from the periphery, and lack both lips and a hood.

Range. Pleistocene to Holocene.

Remarks. Ventrostoma differs from *parafissurina* in having its aperture completely separated from the periphery rather than being shifted to one side with an overhanging hood.

Jones (1984) referred several of McCulloch's (1977) species to *Wiesnerina*, which we recommend be referred to *Ventrostoma* Schnitker. These include *Parafissurina erectiformis* McCulloch, *P. decipiens* McCulloch, and *P. mitrata* McCulloch.

Walterparria Jones, 1984

Walterparria JONES, 1984, p. 129.

Type species. Lagena milletti Chaster, 1892, p. 89, pl. 1, fig. 10; by original designation.

Diagnosis. A genus of Ellipsolageninae whose species have elongate, ovate tests with a terminal to slightly subterminal aperture, and aperturallips that resemble a sucker-disc.

Range. Pleistocene to Holocene (from the literature).

Wiesnerina Jones, 1984
Pl. 4, Figs. 9-11; Pl. 5, Fig. 13

Wiesnerina JONES, 1984, p. 124.

Type species. Lagena unguis Heron-Allen and Earland, 1913, p. 86, pl. 7, figs. 1-3; by original designation.

Diagnosis. A genus of Ellipsolageninae whose species have carinate tests and an aperture at the junction of the carina and test.

Range. Pleistocene to Holocene (from the literature),

Remarks. The type species of *Wiesnerina* is an extreme example of the degree of curvature of the carina and test, Our studies show variation in the amount of curvature (asymmetry) at the specific level.

Wiesnerina carinata Taylor, n. sp.
Pl. 4, Figs. 9-11; Pl. 5, Fig. 13

Diagnosis. A species of *Wiesnerina* whose broad, thin carina possesses radiating pores.

Description. Test free, unilocular, compressed, circular in outline; wide encircling carina may be slightly concave; wall calcareous, hyaline to translucent, smooth; radial pores confined to carina; aperture an elongate, narrow slit at juncture of chamber and carina, with thin lip; entosolenian tube attached to opposite wall, terminating at base of test.

Etymology. From the Latin, *carinatus*, keeled, with reference to the carinate test.

Dimensions. Maximum length, 500 µm; maximum width 480 µm.

Material. 10 specimens.

Types and occurrence. Quaternary. Holotype (USNM 383359) and unfigured paratypes (USNM 383363) from DSDP Site 207 (Leg 21), South Lord Howe Rise, Tasman Sea, lat. 36°57,75'S, long. 165°26.06'E, 207-1-2, 68-74 cm.

Remarks. Wiesnerina carinata resembles *Lagena marginata* Walker and Boys as figured by Sidebottom (1912, pl. 18, fig. 2), except that the aperture is at the base of the carina rather than at the margin.

Subfamily SIPHOLAGENINAE, n. subfam.

Type genus. Sipholagena Moncharmont-Zei and Sgarrella, 1980.

Test unilocular, aperture circular, entosolenian tube present, double walls connected by network of pillars.

Sipholagena Moncharmont-Zei and Sgarrella, 1980

Buchneria MONCHARMONT-ZEI and SGARRELLA, 1977, p. 5, (non. Buchneria Borner, 1952).
Sipholagena MONCHARMONT -ZEI and SGARRELLA, 1980, p.1.

Type species. Lagena benevistita Buchner, 1940, p. 445, pl. 7, fig. 101; by original designation.

Diagnosis. A genus of Sipholageninae with a solid outer wall.

Range. Oligocene to Holocene.

Pytine Moncharmont.Zei and Sgarrella, 1978

Pytine MONCHARMONT-ZEI and SGARRELLA, 1978, p. 2.

Type species. pytine parthenopeia Moncharmont-Zei and Sgarrella, 1978; by original designation.

Diagnosis. A genus of Sipholageninae whose species have tests with an outer wall of longitudinal stripes.

Range. Miocene to Holocene.

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