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SOME EOCENE AND OLIGOCENE PHYTOPLANKTON FROM THE GULF COAST, U.S.A.

WARREN S. DRUGG
and
ALFRED R. LOEBLICH, JR.
CHEVRON RESEARCH COMPANY
LA HABRA, CALIFORNIA

CONTENTS

I. Abstract

Four distinctive new dinoflagellate species are described from the Gulf Coast Tertiary. Two of these are made the bases for new genera: *Phthanoperidinium,* type species *P. amoenum* from the Oligocene of Mississippi, and *Heteraulacacysta,* type species *H. campanula* from the Eocene of Alabama. These genera are made the bases for the new families Phthanoperidiniaceae and Heteraulacacystaceae. A new species of *Homotryblium* is described from the Oligocene of Mississippi and one of *Operculodinium* from the Eocene and Oligocene. The new combination *Heteraulacus polyedricus* (Pouchet) is made for the former *Peridinium.* Two new acritarch genera *Ascostomocystis* and *Cyclopsiella,* each have two new species. The species *Ascostomocystis hydria* occurs in the Alabama Eocene and *A. potane* in the Mississippi Oligocene. Both *Cyclopsiella elliptica* and *C. vieta* occur in the Oligocene of Mississippi.

II. Introduction

The authors are presently engaged in an extensive investigation of phytoplankton from the Gulf Coast Lower Tertiary. During the course of this study, many new taxa have been recovered, some of which are described here. The types are deposited, at present, in the collections of the Chevron Research Company, La Habra, California.

III. Acknowledgments

The authors extend their appreciation to the Mississippi Geological Survey for the use of material resulting from their "type localities sampling program". We thank Dr. Helen Tappan Loeblich, Dr. Jere Lipps, and Mrs. Karen Loeblich Lipps for aid in collecting the samples from Alabama. Dr. W. R. Evitt of Stanford University provided helpful criticism regarding *Homotryblium* tabulation, and A. R. Loeblich III discussed various aspects of the fossil and living dinoflagellates.

IV. Systematic Descriptions

Class Dinophyceae Fritsch, 1935
Order Peridiniales Haeckel, 1894
Family Phthanoperidiniaceae Drugg and Loeblich, n. fam.

Proximate fossil cysts, ambitus ovoidal to polygonal in shape. Apical and antapical horns may be present. Reflected tabulation 4′, 2-3a, 7″, 5‴, 2⁗. Additional furrow platelets may sometimes be visible. The

archeopyle is intercalary. Sutures delineated by low ridges, crests, or lines of spines.

Type Genus: *Phthanoperidinium* Drugg and Loeblich, n. gen.

Genus PHTHANOPERIDINIUM Drugg and Loeblich, n. gen.

Proximate fossil cysts, more or less ovoidal in shape, with a short apical projection. Tabulation 4′, 3a, 7″, 5‴, 2⁗. Additional furrow platelets may be present. The archeopyle is formed by the removal of intercalary plate 2a. Sutures delineated by low ridges, crests, or lines of spines.

Type Species: *Phthanoperidinium amoenum* Drugg and Loeblich, n. sp.

Remarks: Peridinioid fossil cysts with a more definite tabulation have generally been placed in the extant genus *Peridinium.* We propose the genus *Phthanoperidinium* because we agree with the view of Downie and Sarjeant *in* Davey, Downie Sarjeant and Williams (1966, p. 17) that it is unwise to force fossil cyst taxa into a classification scheme based on the living motile thecate form, especially when it has been shown that different members of a single genus as presently defined may produce widely varying types of cysts.

The generic name is from the Greek *phthano*, anticipate, do first + *Peridinium*, modern dinoflagellate genus. Gender: neuter.

PHTHANOPERIDINIUM AMOENUM Drugg and Loeblich, n. sp.

Pl. 1, figs. 1-5; text-figs. 1a-e

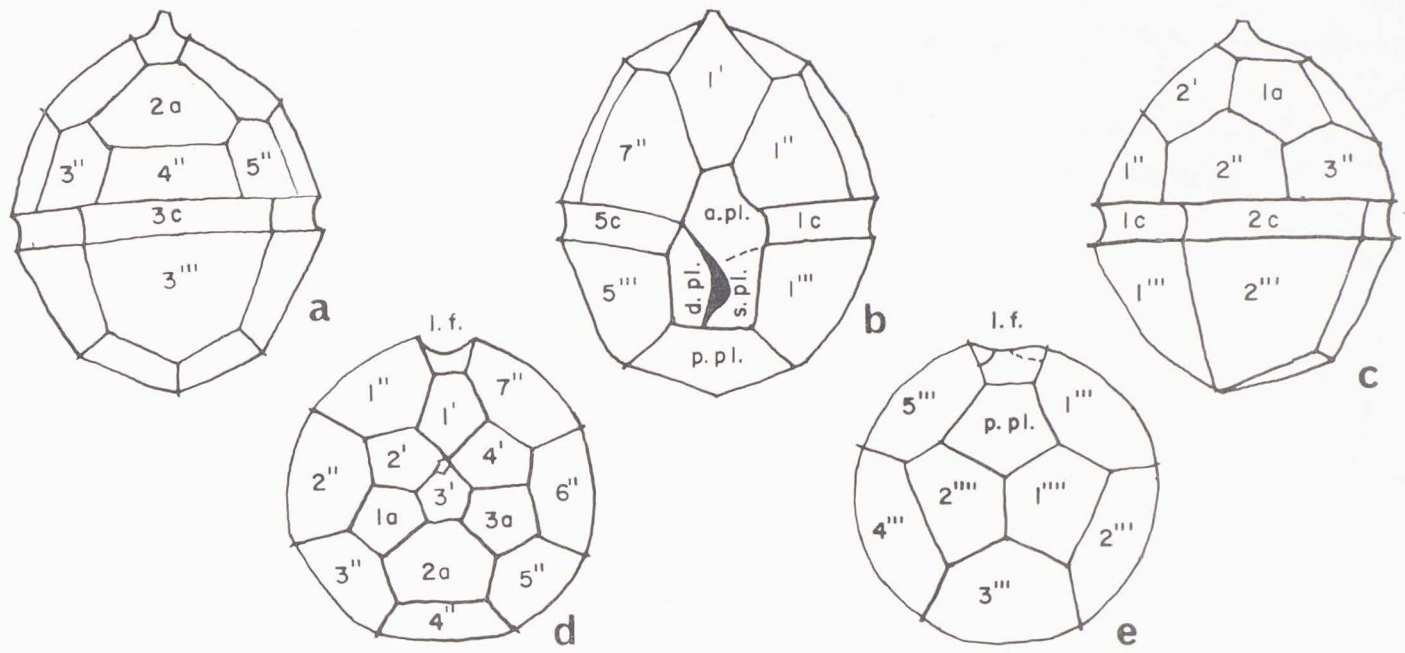
Tract small, oval, neatly tabulated. A short horn, 4-5 μ long, is located at the apex of the tract. This small horn is probably related to the apical pore of the present day marine *Peridinium.* There are no horns at the antapex. A slightly helicoid cingulum is present midway between the apices. The tabulation is 4′, 3a, 7″, 5c, 5‴, 1a. pl., 1d-pl., 1s.pl., 1p.pl., 2⁗ (see text-figs. 1 a-e). The archeopyle is formed by the loss of the six-sided intercalary plate 2a. The sulcal area contains one anterior platelet, a right and left median platelet, and a posterior ventral plate. The median platelet (s. pl.) is usually weakly expressed or absent. A raised small dark area (see pl. 1, fig. 5) in the center of the sulcal area is presumably related to the flagellar fin of the motile stage. The large posterior ventral plate (p. pl.) entirely fills the lower part of the sulcus. The sutures are low and finely and clearly denticulate. The wall varies from smooth, to finely granulate, to vermiculate. For the latter pattern see pl. 1, fig. 1. Endophragm and periphragm not clearly differentiated, but both layers are seemingly thin.

Holotype 38 μ high, 35 μ wide; paratype (fig. 2a, b) 34 μ high, 33 μ wide; paratype (fig. 3a, b) 41 μ high, 39 μ wide. Range 34-46 μ high, 33-43 μ wide. Average size 41 μ high, 38 μ wide. Heights given exclude the apical horn. Approximately 200 specimens examined.

Remarks: This species undoubtedly is referable to Jörgensen's Tabulata Section of the extant Peridiniaceae. Within this section it resembles that group of marine species having three intercalary plates, such as the living species *Peridinium nudum* Meunier. The fossil species most closely resembling *Phthanoperidinium amoenum,* n. sp., are *Peridinium eocenicum* Cookson and Eisenack, 1965, and *P. resistente* Morgenroth, 1966. The new species differs from *Peridinium eocenicum* in lacking an antapical horn, and in its larger size. It also differs in possessing relatively low and dense sutural ledges as compared to the high and transparent ledges of *P. eocenicum.* It differs from *P. resistente* in its larger size and non-granulate sutural ledges. The large posterior ventral plate differentiates *P. amoenum* from both other species.

The specific name is from the Latin *amoenus,* pleasant, delightful.

Types and Occurrence: Holotype Chevron Research Cat. No. 25706-6 (1) 35-100; Paratype, Cat. No. 25706-6 (1) 37-94; Paratype, Cat. No. 25706-6 (1) 24-110; Paratype, Cat. No. 25706-6 (2) 31-99; Paratype, Cat. No. 25706-6 (2) 20-100. All from the Oligocene Mint Spring Marl from an outcrop sample taken beneath the waterfall at Mint Spring Bayou, just south of the gate to the National Military Cemetery on U.S. Highway 61 (Business Route) in Vicksburg, Sec. 13, T16N, R3E. Warren County, Mississippi. Collected by W. S. Drugg and A. R. Loeblich.



Text figure 1. *Phthanoperidinium amoenum* Drugg and Loeblich, n. sp. a, dorsal view. b, ventral. c, lateral view. d, apical view. e, antapical view.

Family HETERAULACACYSTACEAE Drugg and Loeblich, n. fam.

Proximate fossil cysts, more or less polyhedral in shape. Archeopyle cingular. Basic tabulation 3′, 7″, 5‴, 3⁗. Sutures delineated by low crests or ridges.

Type Genus: *Heteraulacacysta* Drugg and Loeblich, n. gen.

Remarks: This family is envisioned to encompass fossil cysts with a cingular archeopyle which are seemingly related to the extant genera *Heteraulacus* and *Goniodinium.* Therefore the tabulation formula is subject to change, depending on future finds of fossil material. To date no fossil cysts of the *Goniodinium* type tabulation have been reported.

Genus HETERAULACACYSTA Drugg and Loeblich, n. gen.

Proximate fossil cyst with a cingular archeopyle. The epitract is bell-shaped, the hypotract is cup-shaped, and the transverse section is more or less circular. The tabulation is 3′, 7″, 5‴, 3⁗. Plates 1″ and 7″ are commonly absent or weakly expressed.

Type Species: *Heteraulacacysta campanula* Drugg and Loeblich, n. sp.

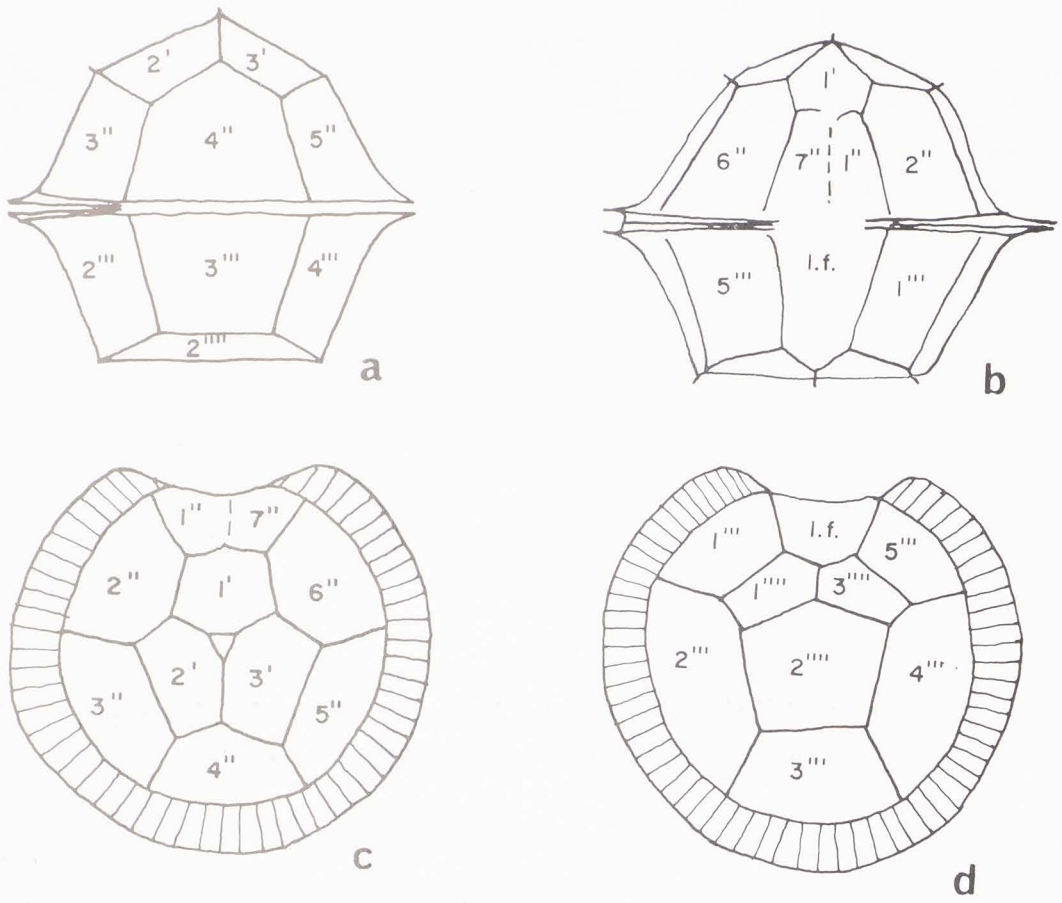
Remarks: This fossil genus is quite obviously related to the living genus *Heteraulacus* Diesing, 1850 (objective senior synonym of *Goniodoma* Stein, 1883). The type species of our new genus bears a close resemblance to the living species *Heteraulacus polyedricus* (Pouchet) Drugg and Loeblich, *comb. nov.* (Basionym: *Peridinium polyedricum* Pouchet, 1883, Jour. Anat. Physiol., v. 19, p. 440, fig. 34).

The generic name is from *Heteraulacus,* modern dinoflagellate genus + cysta from Greek, *kystis,* bladder, sac, cyst. Gender: feminine.

HETERAULACACYSTA CAMPANULA Drugg and Loeblich, n. sp.

Pl. 1, figs. 6-8c; text figs. 2a-d

Same as for the genus with the following additional comments. Both endophragm and periphragm are thin. The endophragm is smooth but the periphragm is commonly ornamented with grana and irregular spines that may fuse to form a very crude microreticulum. The sutural ledges arise from the periphragm and are about 5 μ high, and radially striate. The cingular flanges are about 7 μ wide and are radially striate. They fit closely together with no cingular furrow between them, but they may be displaced laterally from each other. The tabulation is clearly of the *Heteraulacus* type (text-fig. 2a-d) except that plates 1″ and 7″ are indistinct or absent altogether, being submerged in the sulcal furrow. Morgenroth (1966, p. 7, pl. 2, fig. 7-9) described a fossil form which he referred to the extant species *Goniodoma polyedricum* (Pouchet) Jörgensen, 1899. This form exhibits plates 1″ and 7″ very clearly. A small triangular area,



Text figure 2. *Heteraulacacysta campanula* Drugg and Loeblich, n. sp. a, dorsal view. b, ventral view. c, apical view. d, antapical view.

present at the apex of the epitract, presumably reflects the apical pore of the living *Heteraulacus.*

Holotype, 70 μ high, 90 μ wide. Range 55-72 μ high, 63-97 μ wide. The holotype is of average size. Approximately 200 specimens examined.

Remarks: The specific name is from the Latin *campana,* bell; *campanula* diminutive.

Types and Occurrence: Holotype Chevron Research Cat. No. 24047-1 (2) 37-93; Paratypes, Cat. Nos. 24047-1 (2) 57-109 (pl. 1 fig. 6) and 24047-1 (2) 34-95 (pl. 1, fig. 7). All from the middle Eocene Gosport Sand, outcrop sample taken at Little Stave Creek, 3.5 miles north of Jackson, west side of U.S. Highway 43, Washington County, Alabama. Collected by K. E. and J. H. Lipps and H. T. and A. R. Loeblich, Jr.

Family HOMOTRYBLIACEAE Sarjeant and Downie, 1966

Genus HOMOTRYBLIUM Davey and Williams, 1966

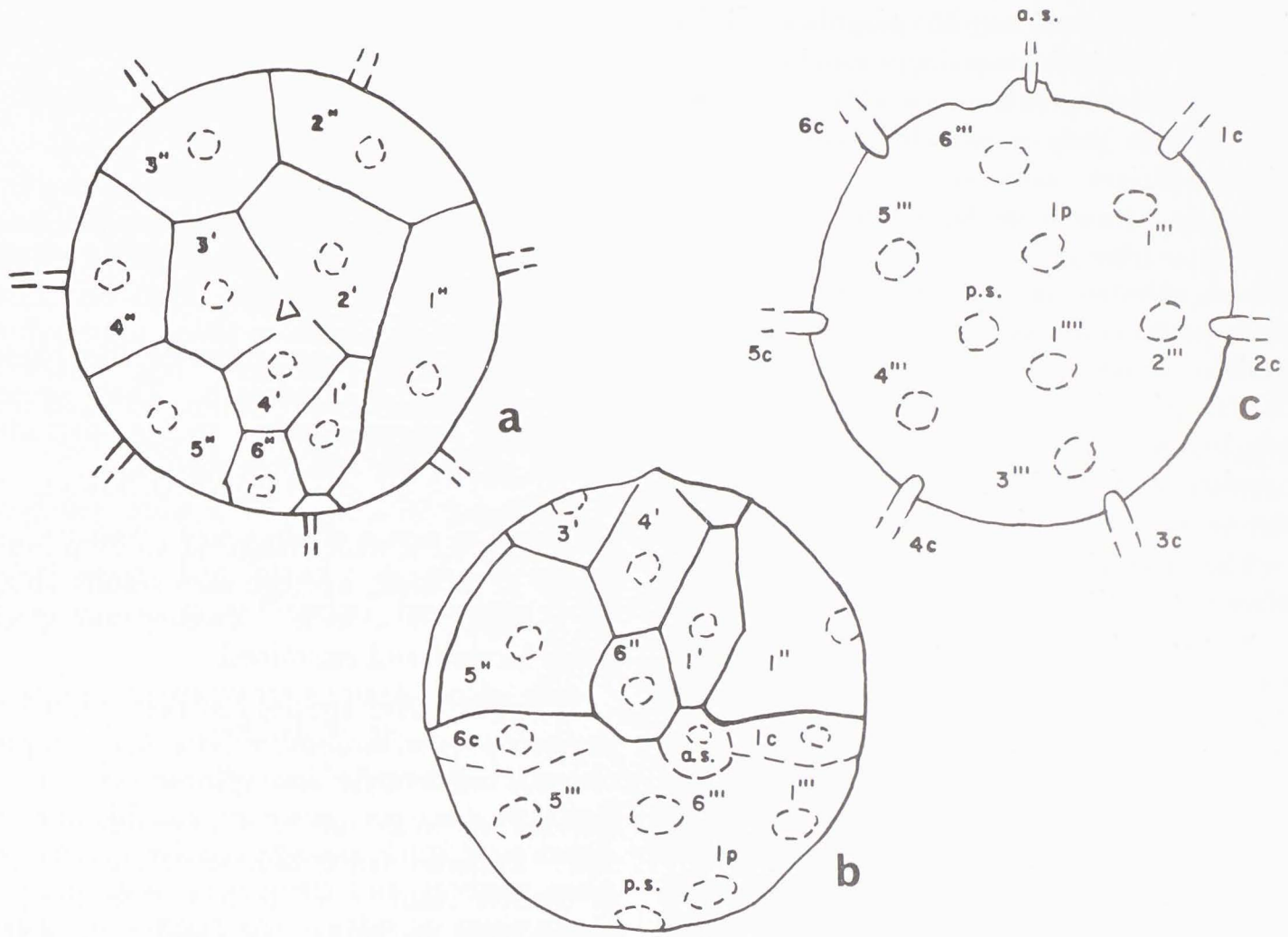
HOMOTRYBLIUM PLECTILUM Drugg and Loeblich, n. sp.

Pl. 2, figs. 1-9; text-figs. 3a-c

Spherical chorate cyst with thin endophragm and periphragm, the latter giving rise to the processes. The wall is about 1 μ thick with the periphragm slightly thinner than the endophragm. Wall smooth to faintly and delicately granulate. Both layers commonly granulate or only the endophragm may exhibit this feature. The processes are intratabular, buccinate, entire to secate, open distally but not opening into the central cavity. The walls of the processes are striate and may be faintly fibrous. The striations are formed by three or four nerve-like delicate thickenings which extend from the distal terminations to the basal areas where they radiate outwardly for a short distance.

The distal ends of the processes are entire or else may be secate with from two to six lobes. The archeopyle is epitractal with the line of separation just above the cingular processes.

The morphology of the archeopyle is the same as that described and illustrated by Evitt (1967, p. 49, pl. 9, figs 7-16) and termed "Type 2A + 6P". The epitract usually fragments into its constituent plates. The apex consists of three plates (2-4′) joined centrally by a faint triangular thickening, the latter possibly reflecting an apical pore. These three plates commonly remain together as a unit (see pl. 2, fig. 6). The six precingular plates and plate 1′ usually



Text figure 3. *Homotryblium plectilum* Drugg and Loeblich, n. sp. a, apical view. b, ventral view. c, antapical view. Processes not shown, but position indicated by dotted circles and radiating spokes.

separate as individual entities. The hypotract exhibits three series of processes, a circle of seven at the top, then a circle of six, and finally a group of three at the antapex. Those at the top of the hypotract clearly consist of six singular plate processes and one anterior sulcal process. The latter is of considerably smaller size than the other processes of this series. It occurs on, or slightly below, a small projection or tab on the rim of the hypotract. Tiny notches on the upper edge of the hypotract are commonly visible between the cingular processes and, rarely, faint lines are visible which outline the cingular plates.

The terminology for the remaining nine processes on the hypotract is problematical since the tabulation is only inferred. The most probable tabulation for this species is 4′, 6″, 6c, la.p., ls.p., 6‴, 1p, 1⁗ (see text-fig. 3a-c). Some specimens exhibit one or more peculiar ring-shaped internal structures. These thickenings of the endophragm are about 10 μ in total diameter with a somewhat variable rim width. Rarely, a small hole is present in the center of the ring (see pl. 2, fig. 4). As many as three of these structures have been seen on one specimen, but only one is usual and this occurs at the antapical end opposite the projection on the hypotract rim.

Holotype, body 43 μ, processes 14 μ. Range, body 37-70 μ with most being about 50 μ. The processes range from 14-26 μ in length, usually about 20 μ. Several hundred specimens examined.

Remarks: This species is probably close to *Homotryblium tenuispinosum* Davey and Williams, but the shape and arrangement of the epitractal plates were not given for that species. An exact comparison with *H. plectilum* is therefore not possible. Davey and Williams give two different formulae for the hypotract (p. 100, 101), one of which is no doubt a misprint. That shown for *H. tenuispinosum* is essentially the same as that of *H. plectilum* as regards the basic number of processes but the interpretation differs slightly. Such inferred tabulations, however, are to some extent a matter for conjecture. Aside

from these questions, *H. plectilum* differs from *H. tenuispinosum* in possessing striate processes, more robust cingular processes, and at best only a weakly granulate wall. *Homotryblium tasmaniense* Cookson and Eisenack differs from *H. plectilum* most obviously in that it possesses a coarsely granulate to spinose wall. Once again epitractal plate patterns are not given so further comparison is not possible. The relationships of *H. plectilum* are not known, but the tabulation of the epitract and the apparent tabulation of the hypotract are suggestive of the extant genus *Gonyaulax.*

The specific name is from the Greek *plecto, plectilis,* plaited, complicated.

Types and Occurrence: Holotype from the Oligocene Forest Hill Formation (depth 36.5 feet) Chevron Research Cat. No. 26631-5 (2) 44-97 in Mississippi Geological Survey Core Hole AF-8, located just off south side of State Highway 18 at juncture with Forest Hill Road in SE 1/4, SE 1/4, NE 1/4, Sec. 22, T5N, R1W, Hinds County, Mississippi. Paratypes, all from the Oligocene Glendon Limestone, Chevron Research Cat. Nos. 26548-1 (1) 36-93; 26548-1 (1) 42-96; 26548-1 (1) 42-106; 26548-1 (3) 32-97; 26548-1 (1) 20-101 (all preceding at depth of 82 feet); 26548-2 (3) R 65-105 (depth 84 feet); 26548-3 (1) 41-106 (depth 85 feet) and 26548-5 (2) 65-102 (depth 90 feet) in Mississippi Geological Survey Core Hole AF-56 located 25 feet south of gravel private road in approximate center SW 1/4, SW 1/4, Sec. 3, T6N, R4W, Hinds County, Mississippi.

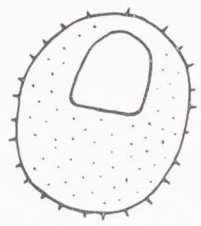
Family INCERTAE SEDIS

Genus OPERCULODINIUM Wall, 1967

OPERCULODINIUM PLACITUM Drugg and Loeblich, n. sp.

Pl. 1, figs. 9-11b; text-fig. 4

Tract small, elliptical in outline. The precingular archeopyle is more or less elliptical in outline at the top with a squared-off lower edge. It is located on the upper face of the tract and extends from near the apex to the equator. The wall is about 1 to 1.5 μ thick, endophragm thinner than periphragm. The latter is finely granulate and



Text figure 4. *Operculodinium placitum* Drugg and Loeblich, n. sp. showing shape and position of archeopyle.

ornamented with short, more or less blunt, spines of about 1 μ in length. These spines are spaced approximately 1 to 2 μ apart and do not reflect any apparent tabulation.

Holotype, 36 μ high, 27 μ wide; paratype 37 μ high, 32 μ wide; range 32 to 39 μ high, 24 to 32 μ wide; average dimensions about 36 μ high, 28 μ wide. Twenty-two specimens located and examined.

Remarks: This species has been placed in the genus *Operculodinium* because of its precingular archeopyle and spinose ornamentation. It does not, however, exhibit any indication of spine arrangements suggestive of plate patterns, and there is no indication of a cingulum or sulcus. As regards described species it most closely resembles *Pyxidiella pandora* Cookson and Eisenack, 1958, and *P. scrobiculata* (Deflandre and Cookson) Cookson and Eisenack, 1958. It differs from the former in its smaller size and in bearing coarser and more scattered ornamentation. It differs from *P. scrobiculata* in the smaller size, and thinner nonpunctate wall. From both species it differs in possessing a precingular archeopyle instead of an intercalary archeopyle.

The specific name is from the Latin *placitus,* pleasing.

Types and Occurrence: Holotype, Chevron Research Cat. No. 26548-5 (3) 27-93 (depth 90 feet) and paratype (pl. 1, fig. 10) 26548-13 (1) 39-108 (depth 100 feet) from the Oligocene Glendon Limestone in Mississippi Geological Survey Core Hole AF-56 located 25 feet south of gravel private road in approximate center SW 1/4, SW 1/4, Sec. 3, T6N, R4W, Hinds County, Mississippi. Paratype from the upper Eocene Cocoa Sand, 24045-4 (8) 19-98, outcrop sample taken at Little Stave Creek, 3.5 miles north of Jackson, west side of U.S. Highway 43, Washington County, Alabama. Collected by K. E. and J. H. Lipps and H. T. and A. R. Loeblich, Jr.

Group ACRITARCHA Evitt, 1963
Subgroup Uncertain
Genus ASCOSTOMOCYSTIS Drugg and Loeblich, n. gen.

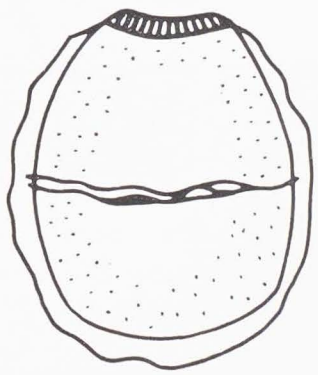
Flask-shaped cyst, more or less elliptical in outline, with an aperture at the apex. Wall two-layered, endophragm relatively thick and rigid, periphragm thin and filmy. Periphragm tends to adhere to endophragm "dorsally" and "ventrally" but remains free and bag-like around the circumference.

Type Species: *Ascostomocystis hydria* Drugg and Loeblich, n. sp.

Remarks: The generic name is from the Greek *askos,* bag, bladder + *stoma,* mouth + *kystis,* sac, cyst. Gender: feminine.

ASCOSTOMOCYSTIS HYDRIA Drugg and Loeblich, n. sp.
Pl. 3, figs. 13-15; text-fig. 5

The description is the same as for the genus with these additional remarks. The endophragm is about 1 μ thick, smooth to finely granulate, and forms an inner body. The periphragm is somewhat variable in its degree of freedom at the periphery. In a few specimens it adheres closely to the endophragm but in most is quite free. An unusual degree of freedom is exhibited by the specimen pictured in pl. 3, fig. 14. Commonly the filmy periphragm is wrinkled except where it adheres to the endophragm



Text figure 5. *Ascostomocystis hydria* Drugg and Loeblich, n. sp.

"dorsally" and "ventrally", a feature characteristic of most specimens. Commonly, a noticeable transverse "equatorial wrinkle" on the periphragm is suggestive of a girdle. A few specimens break in half along this line, but this is presumably accidental. The tract is compressed "dorso-ventrally" and the apical opening has an elliptical outline. This apical opening is rimmed and is about 17 μ across. Flattening is probably due to compression, and the original shape was probably more rounded in cross-section, with a circular aperture.

Holotype, 83 μ high, 67 μ wide; paratypes (Pl. 3, fig. 13) 80 μ high and 70 μ wide and (Pl. 3, fig. 14) 80 μ high and 68 μ wide with inner body 55 μ high and 48 μ wide. Range 53-83 μ high, 49-67 μ wide. About 50 specimens examined.

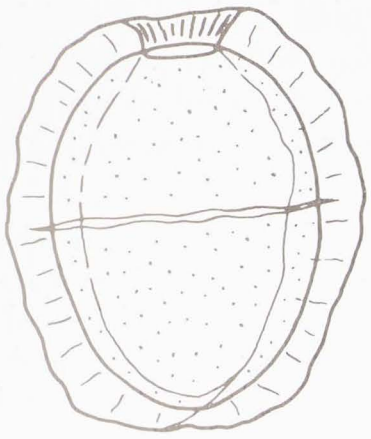
Remarks: This genus and species bears a resemblance to *Palaeostomocystis* Deflandre, 1935. The main point of differentiation is the presence of the filmy periphragm in *Ascostomocystis.* The species *A. hydria* shares some morphological characteristics with *Palaeostomocystis laevigata* Drugg, 1967, in that both are flaskshaped with a two-layered wall. The endophragm of *P. laevigata* was only present in 1 to 2 percent of the located specimens, whereas it is always present in *A. hydria.* Furthermore, *P. laevigata* exhibits a thin endophragm and a relatively thick periphragm, while the reverse is true of *A. hydria.*

The specific name is from the Greek *hydria,* water-pot, jug, urn.

Types and Occurrence: Holotype, Chevron Research Cat. No. 28062 (1) 26-108; Paratypes Cat. Nos. 28062 (2) 32-98 and 28062 (1) 19-107, all from the lower Eocene upper Wilcox "Formation", outcrop sample, gray marls, south side of railroad cut, just east of road bridge over railroad and west of railroad trestle over another railroad, about 0.9 miles north of town square and 0.1 mile north of intersection of North Merrick Avenue and Marley Mills Road in Ozark, Dale County, Alabama. Collected by K. E. and J. H. Lipps and H. T. and A. R. Loeblich, Jr.

ASCOSTOMOCYSTIS POTANE Drugg and Loeblich, n. sp.
Pl. 3, figs. 10-12; text-fig. 6

Cyst elliptical in outline, with an indistinct slit-like aperture at the apex. The wall is two-layered, the endophragm being thin, smooth to faintly granulate, the very thin periphragm adheres closely to the endophragm both "dorsally" and "ventrally". Near the periphery of the inner body formed by



Text figure 6. *Ascostomocystis potane* Drugg and Loeblich, n. sp.

the endophragm, the periphragm separates and forms a sac-like rim passing around the circumference of the inner body (see fig. 11). This rim is swept back slightly, and near the aperture has the form of a collar open to one side. Prominent transverse wrinkles in the periphragm "dorsally" and "ventrally" are suggestive of a girdle equivalent.

Holotype, 95 μ high, 75 μ wide (inner body 85 x 70 μ). Paratype, 100 μ high, 83 μ wide (inner body 83 x 66 μ). Range 73 to 100 μ high, 68 to 85 μ wide. Twenty specimens examined.

Remarks: The specific name is from the Greek *potanos,* winged, flying.

Types and Occurrence: Holotype, Chevron Research Cat. No. 26631-5 (1) 21-102 and paratype 26631-5 (1) 29-105. Both from the Oligocene Forest Hill Formation at a depth of 36.5 feet in Mississippi Geological Survey Core Hole AF-8 located just off south side of State Highway 18 at juncture with Forest Hill Road in SE 1/4, SE 1/4, NE 1/4, Sec. 22, T5N, R1W, Hinds County, Mississippi.

Genus CYCLOPSIELLA Drugg and Loeblich, n. gen.

Cyst small, flattened, ellipsoidal in outline. A small circular aperture is present on one face just below the apex. The aperture is closed by a circular plug.

Type Species: *Cyclopsiella elliptica* Drugg and Loeblich, n. sp.

Remarks: The biological affinities of this genus are uncertain. In general aspect it resembles the green alga *Chlamydomonas* Ehrenberg, 1833. No cysts, however, are known to occur in *Chlamydomonas,* and it does not possess any openings other than a temporary one, in some species, for escape of the protoplast during isogamous reproduction. In such cases the opening is anterior, in the area where the flagella are inserted. The opening in *Cyclopsiella* is distinctly subapical, and this genus is probably a cyst of some form of marine phytoplankton.

The name is from the Latin *Cyclops*

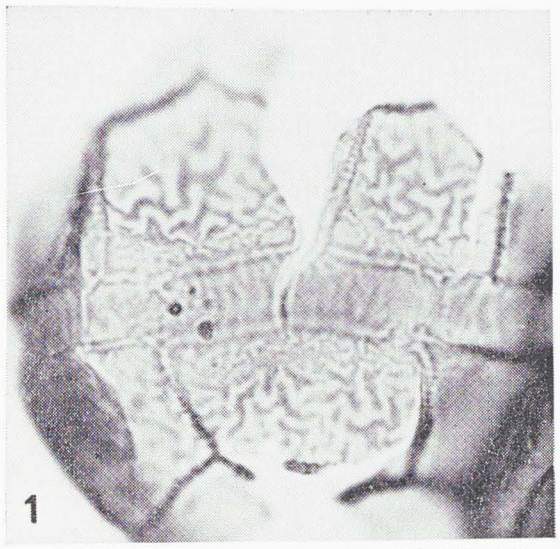
PLATE 1

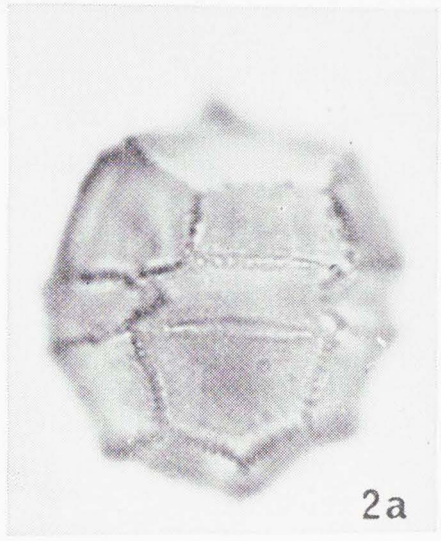
Figures — Page

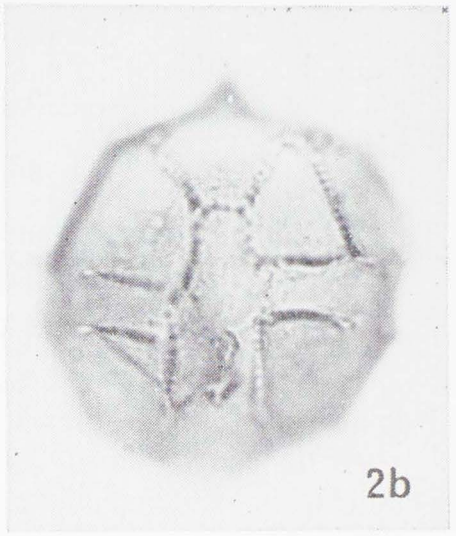
1–5 *Phthanoperidinium amoenum* Drugg and Loeblich, n. sp. 1, paratype showing surface detail, Cat. No. 25706-6 (2) 20-100. 2a, b, paratype dorsal and ventral view, Cat. No. 25706-6 (1) 37-94. 3a, b, paratype dorsal and ventral view, Cat. No. 25706-6 (1) 24-110. 4, holotype ventral view, Cat. No. 25706-6 (1) 35-101. 5, paratype showing sulcal detail, Cat. No. 25706-6 (2) 31-99. All from the Oligocene Mint Spring Marl of Mississippi. X 960 182

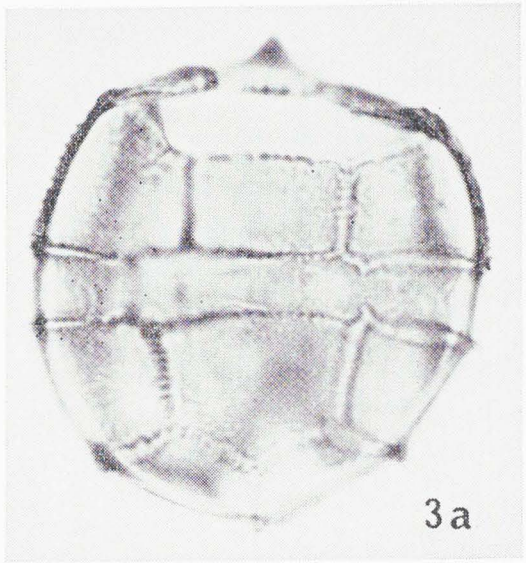
6–8 *Heteraulacacysta campanula* Drugg and Loeblich, n. sp. 6, paratype showing epitract, Cat. No. 24047-1 (2) 57-109. 7, paratype showing hypotract, Cat. No. 24047-1 (2) 34-95, 8a-c, holotype dorsal view, ambital view and ventral view, Cat. No. 24047-1 (2) 37-93. All from the middle Eocene Gosport Sand. X 384 183

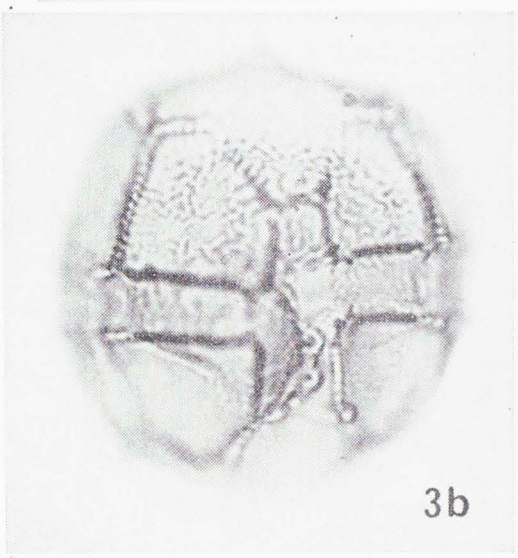
9–11 *Operculodinium placitum* Drugg and Loeblich, n. sp. 9, paratype showing displaced operculum inside tract, Cat. No. 24045-4 (8) 19-98 from the upper Eocene Cocoa Sand of Alabama, X 672. 10, paratype lateral view showing surface detail, Cat. No. 26548-13 (1) 39-108, X 960. 11a, b, holotype dorsal and ventral view, Cat. No. 26548-5 (3) 27-93, from the Oligocene Glendon Limestone, X 672 186

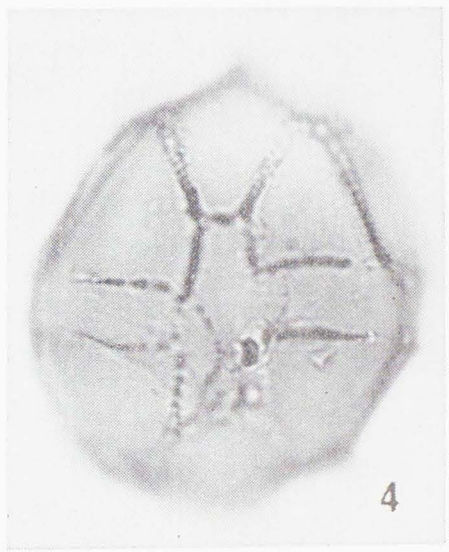


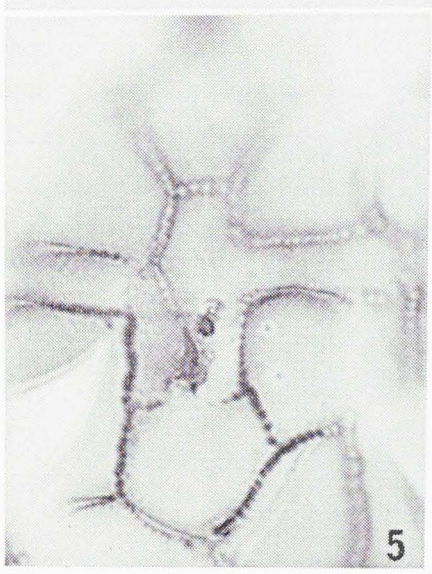


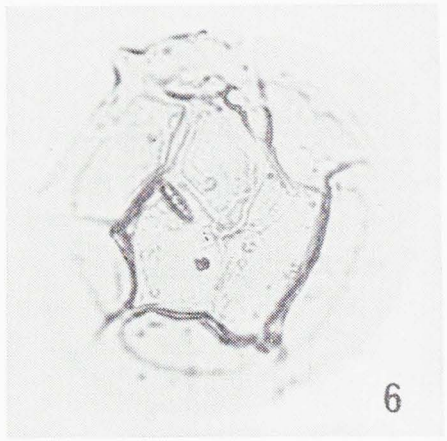


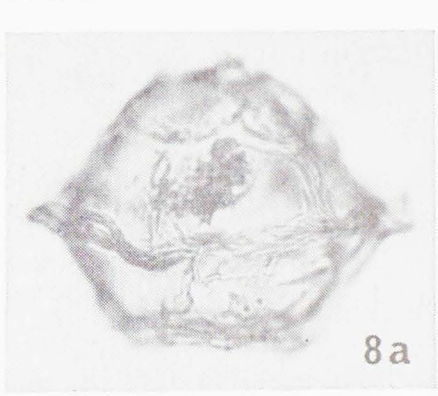


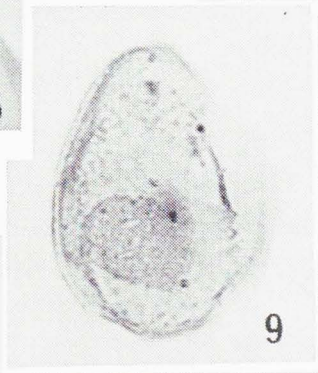


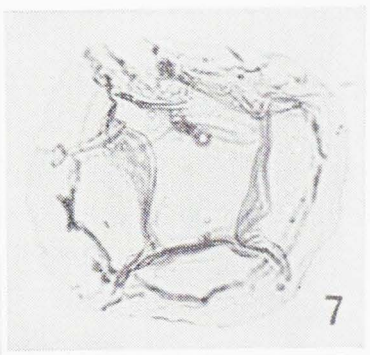


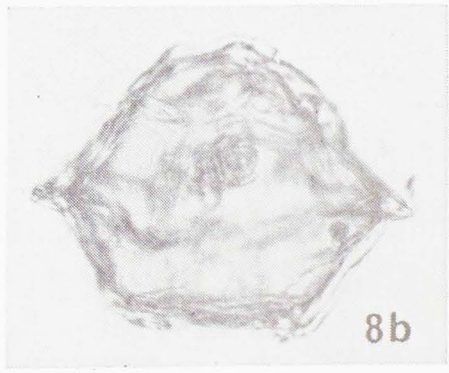


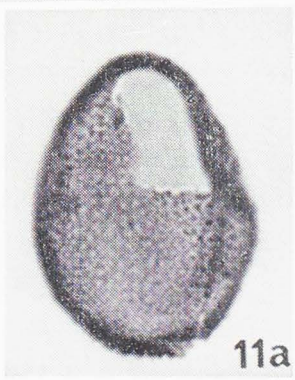












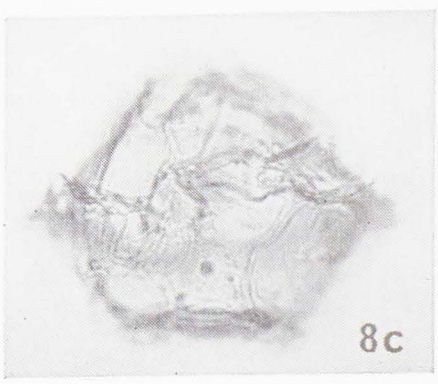


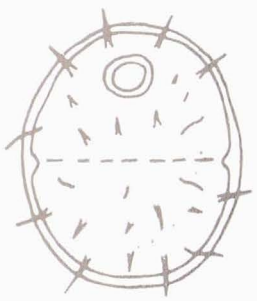
PLATE 1

(Greek *Kyklops*), a mythical one-eyed giant + *ella,* diminutive. Gender: feminine.

CYCLOPSIELLA ELLIPTICA Drugg and Loeblich, n. sp.

Pl. 3, figs. 1-6; text-fig. 7

Description as for the genus, with the following additional remarks. The circular aperture ranges from 5 to 7 μ in diameter and is surrounded by a slightly thickened rim. The apertural plug, or operculum, is constructed of a relatively dense and easily stained material, as compared to the normal wall material. These opercula occur in place, partially detached, or may be absent altogether. The two-layered wall is about one micron in thickness. The endophragm is



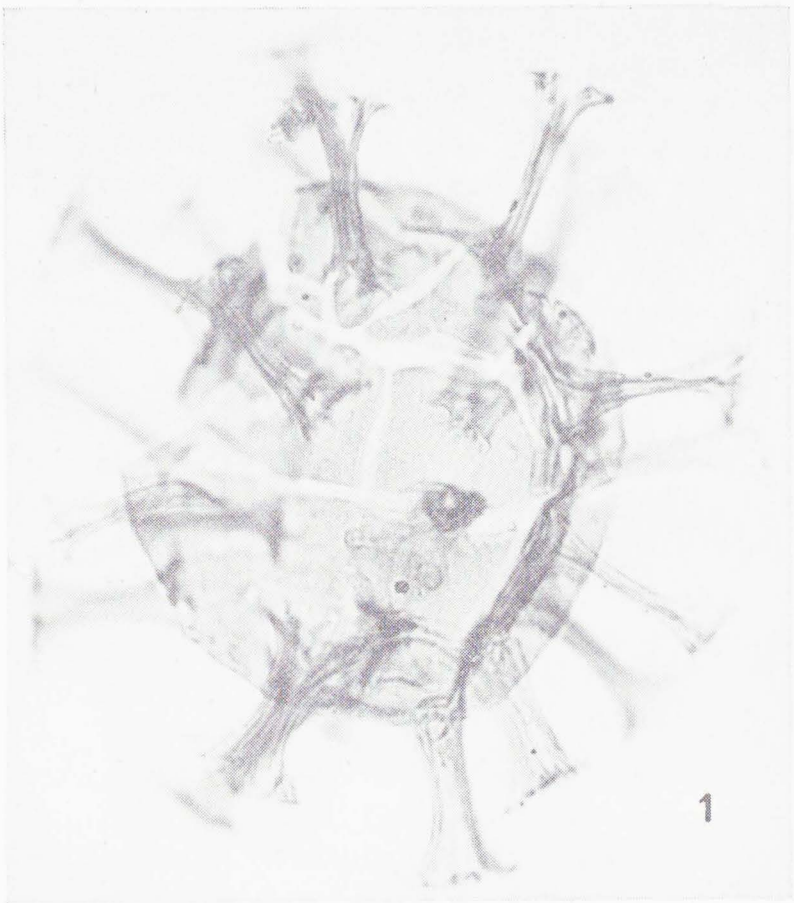
Text figure 7. *Cyclopsiella elliptica* Drugg and Loeblich, n. sp.

relatively thick and is smooth to faintly granulate. This inner layer is commonly slightly thickened internally in a band passing around the center of the cyst, which is suggestive of a cingulum or line of division. The periphragm is thin, filmy, and closely appressed to the endophragm. Delicate acuminate processes commonly occur. They originate from the outer layer and are more numerous and pronounced on the "dorsal" side of the cyst. They range from extremely short to about 7 μ in length. Rarely, remnants of a thin flange around the circumference of the cyst are visible.

Holotype—44 μ high, 37 μ broad. Paratypes (pl. 3, fig. 3) 49 μ high, 42 μ broad; (pl. 3, fig. 4) 41 μ high, 36 μ broad; (pl. 3, fig. 5) 40 μ high, 35 μ broad; (pl. 3, fig. 6) 43 μ high, 38 μ broad. Range 30 to 60 μ high, 26 to 48 μ broad. About two hundred specimens located and examined. The holotype represents an average size.

Types and Occurrence: Holotype Chevron Research Cat. No. 25706-6 (2) 28-90 and paratype Cat. No. 25706-6 (1) 34-98 from the Oligocene Mint Spring Marl, outcrop sample taken beneath the waterfall at Mint Spring Bayou, just south of the gate to the National Military Cemetery on U.S. Highway 61 (Business Route) in Vicksburg, Sec. 13, T16N, R3E, Warren County, Mississippi. Collected by W. S. Drugg and A. R. Loeblich. Paratypes, Chevron Research Cat. Nos. 26548-6 (2) 41-101 (depth 92 feet); 26548-8 (3) 30-93 and 26548-8 (3) 30-93 (depth 94 feet); all from the Oligocene Glendon Limestone in Mississippi Geological Survey Core Hole AF-56 located 25 feet south of gravel private road in approximate center SW 1/4, SW 1/4, Sec. 3, T6N, R4W, Hinds County, Mississippi.

PLATE 2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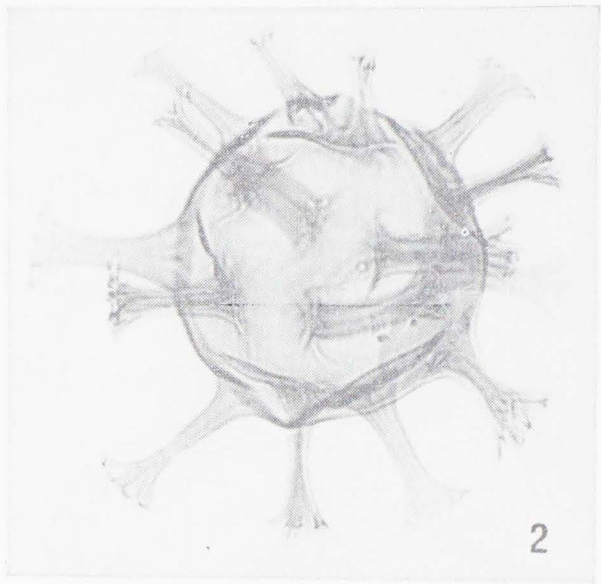
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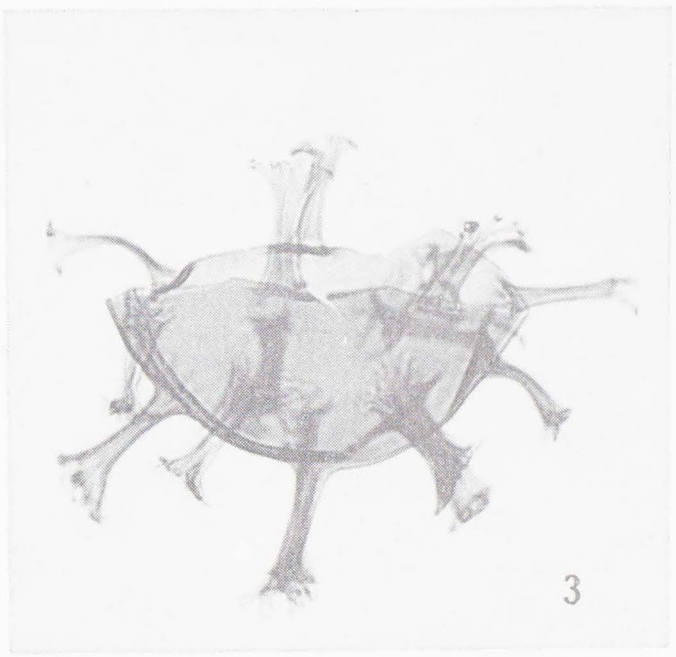
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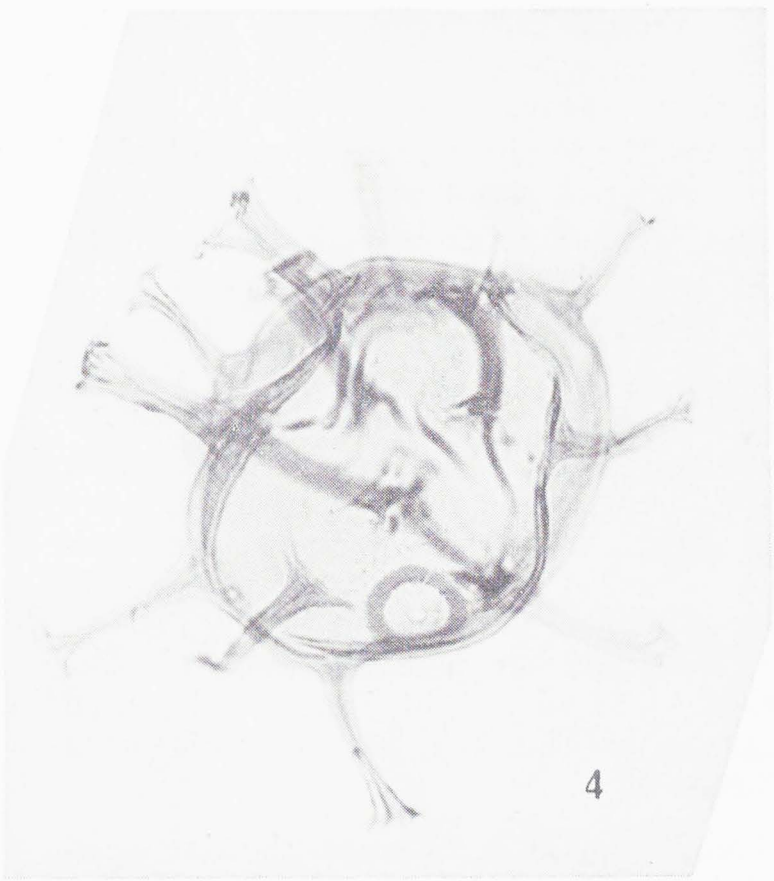
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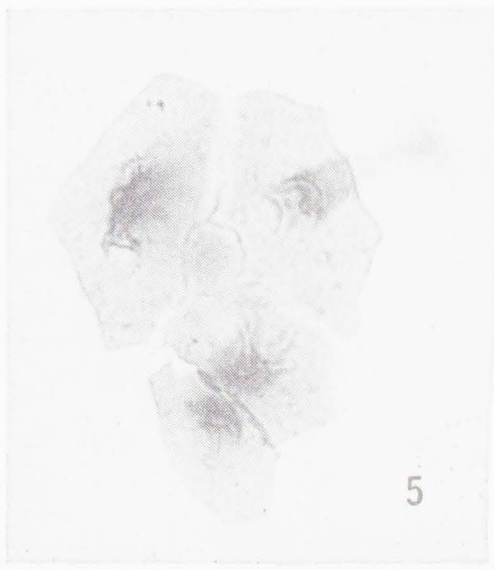
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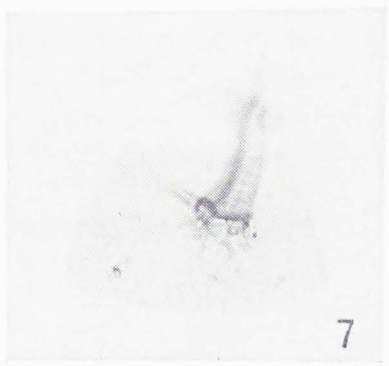
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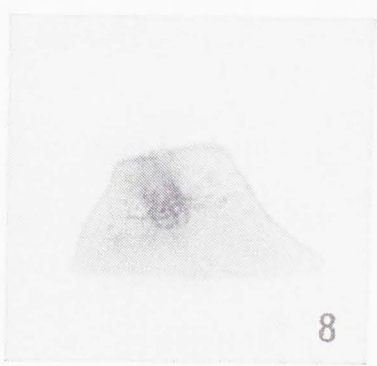
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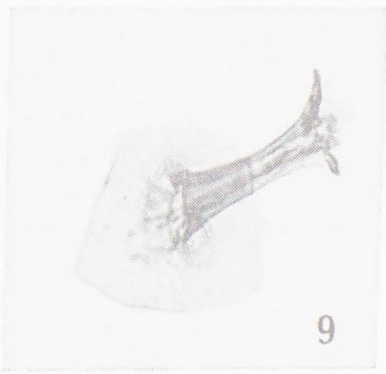
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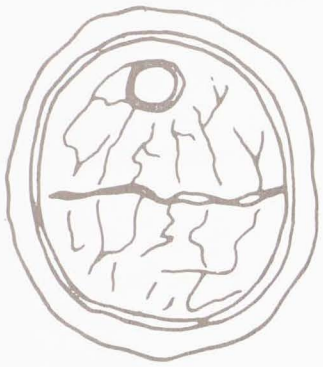
PLATE 2

CYCLOPSIELLA VIETA Drugg and Loeblich, n. sp.

Pl. 3, figs. 7-9; text-fig. 8

Similar to *Cyclopsiella elliptica* in basic morphology. The circular aperture ranges from 5-10 μ in diameter and is bordered by a low rim. The apertural plug, or operculum, is usually not as dense as that of *C. elliptica* and tends to crumble or erode away rather than to separate as a distinct unit. The two-layered wall consists of a relatively thick endophragm and a thin periphragm. The endophragm is about 1 μ thick and is smooth, or may bear scattered grana. The periphragm is thin and generally extends past the endophragm at the circumference to form a flange, or rim, from 3 to 5 μ wide. It may be folded or wrinkled, to form a crude reticulate pattern on the "dorsal" surface. One relatively strong fold may lie in an equatorial position. The "ventral" surface is commonly free of such folding. Some specimens appear to have split around the circumference into two halves.



Text figure 8. *Cyclopsiella vieta* Drugg and Loeblich, n. sp.

Holotype—62 μ high, 59 μ broad (without the flange), flange 5 μ wide. Range 46 to 87 μ high, 41 to 79 μ broad. The holotype is of average size. About 100 specimens located and examined.

Remarks: Some specimens observed were attached to others at the flanges, forming more or less planar clusters. The orientation of the individuals within the cluster seems to be random. This mode of occurrence suggests that *C. vieta* may represent the cysts of a colonial alga.

The specific name is from the Latin *vietus,* shriveled, shrunken, wrinkled.

Types and Occurrence: Holotype, Chevron

PLATE 3

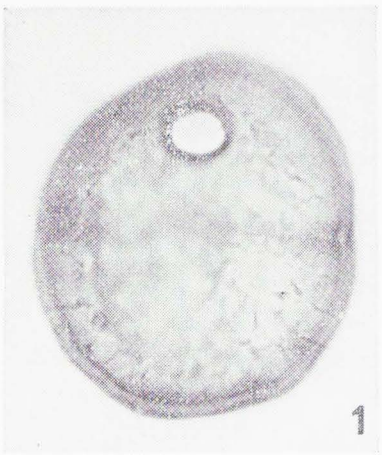
Figures Page

1–6 *Cyclopsiella elliptica* Drugg and Loeblich, n. sp. 1, holotype, showing hair-like processes and circular aperture, Cat. No. 25706-6 (2) 28-90, X 672. 2, holotype, X 512. 3, paratype, showing plug-like operculum partially dislodged, Cat. No. 26548-8 (3) 30-99. 3, X 480. 4, paratype, torn specimen showing constructional detail, Cat. No. 26548-6 (2) 41-101, X 480. 5, paratype, showing plug-like operculum in place, Cat. No. 26548-8 (3) 30-93, X 672. 6, paratype, showing hair-like processes and girdle-like equatorial band, Cat. No. 25706-6 (1) 34-98, X 960. Figs. 1, and 6 from the Oligocene Mint Spring Formation and figs. 2, 3, 5 from the Oligocene Glendon Limestone, both from Mississippi 190

7–9 *Cyclopsiella vieta* Drugg and Loeblich, n. sp. 7, holotype, showing operculum in place, Cat. No. 26548-9 (2) 16-99. 8, paratype, Cat. No. 26548-3 (1) 41-104. 9, paratype showing absence of operculum and strong "girdle-fold", Cat. No. 26548-7 (2) 52-94. All from the Oligocene Glendon Limestone of Mississippi, X 480 192

10–12 *Ascostomocystis potane* Drugg and Loeblich, n. sp. 10, holotype, Cat. No. 26631-5 (1) 21-102. 11, paratype, Cat. No. 26631-5 (1) 29-105. 12, phase-contrast photograph of holotype. Both from the Oligocene Forest Hill Formation of Mississippi. Figs. 10, 11, X 480, fig. 12, X 384 187

13–15 *Ascostomocystis hydria* Drugg and Loeblich, n. sp. 13, paratype, Cat. No. 28062 (2) 32-98. 14, paratype, showing reduced inner body, Cat. No. 28062 (1) 19-107. 15, holotype, Cat. No. 28062 (1). All from the lower Eocene Wilcox "Formation" of Alabama, X 480 187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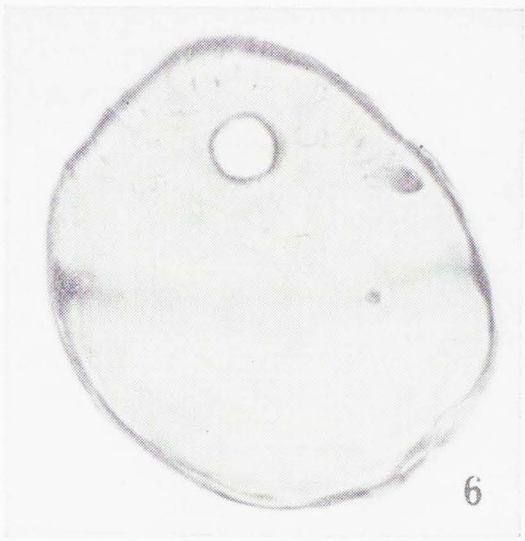
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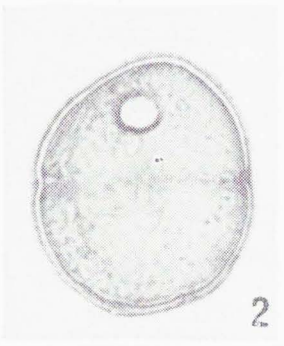
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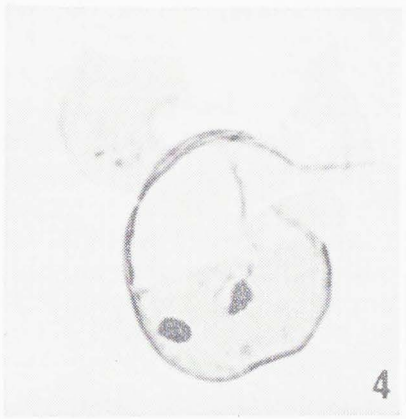
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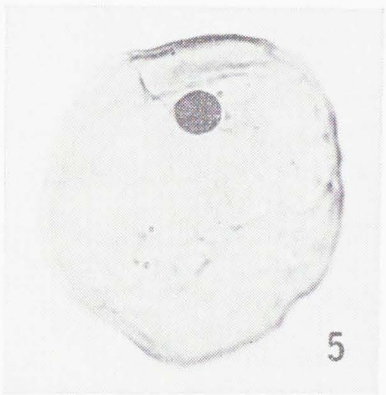
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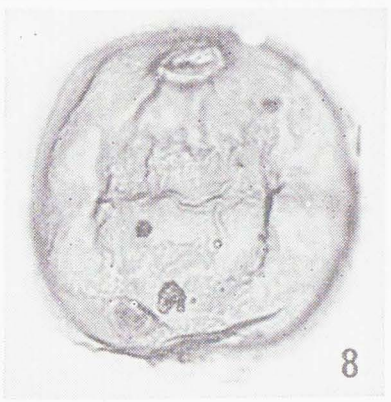
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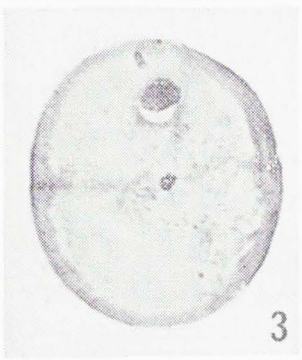
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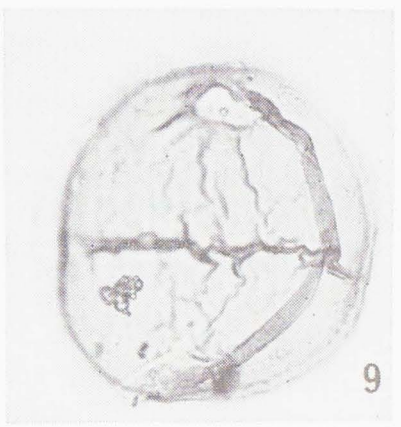
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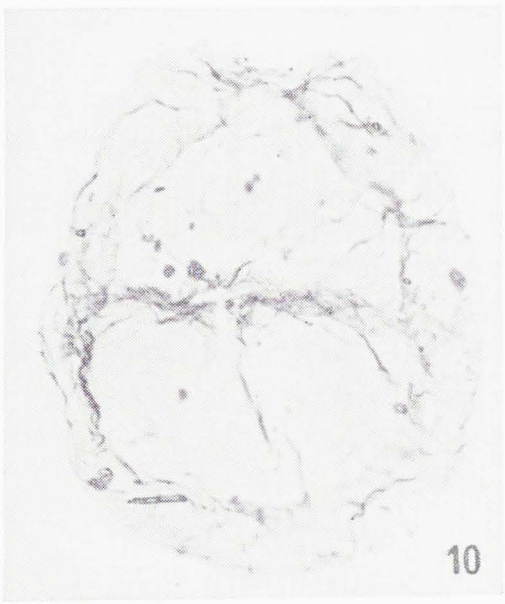
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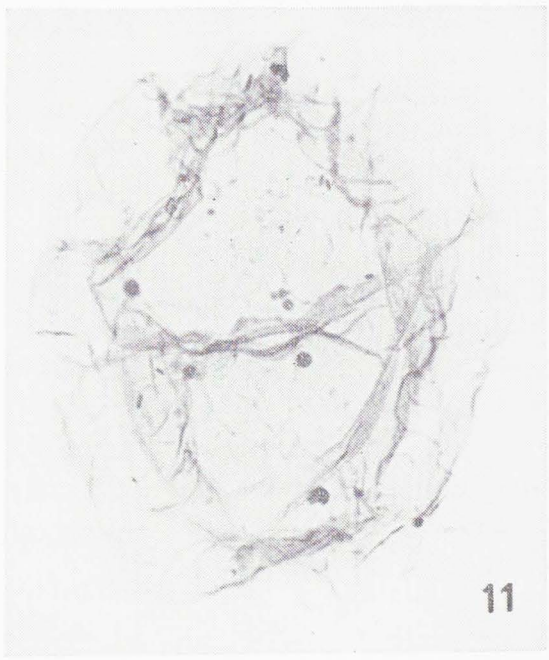
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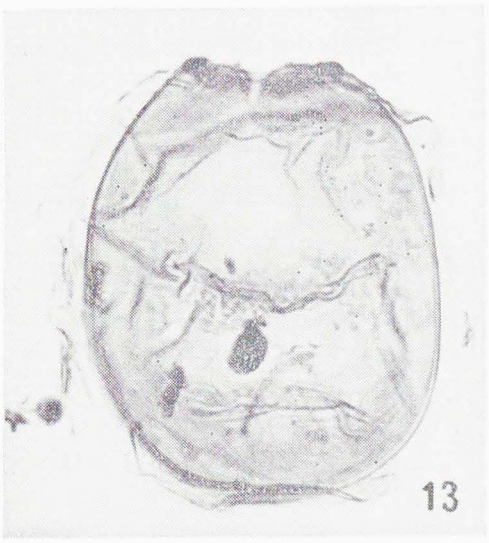
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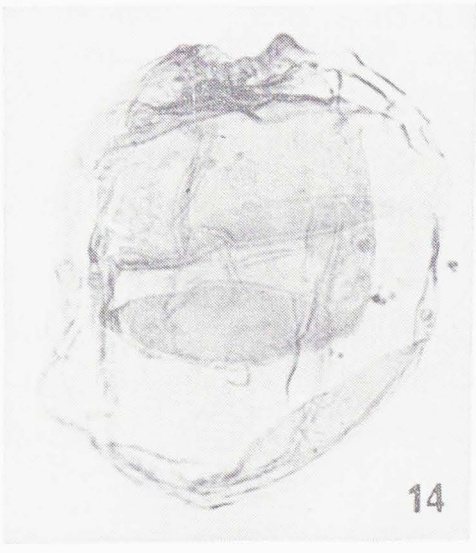
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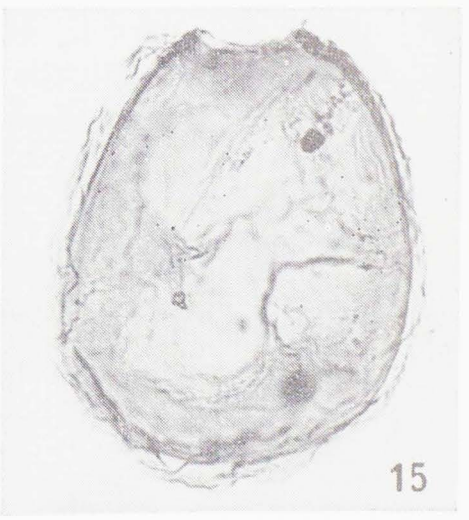
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PLATE 3

Research Cat. No. 26548-9 (2) 16-99 (depth 94.8 feet); paratype Cat. Nos. 26548-3 (1) 41-104 (depth 85 feet) and 26548-7 (2) 52-94 (depth 92.5 feet); all from the Oligocene Glendon Limestone in Mississippi Geological Survey Core Hole AF-56 located 25 feet south of gravel private road in approximate center SW 1/4, SW 1/4, Sec. 3, T6N, R4W, Hinds County, Mississippi.

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