THE CEPHALOPODS OF THE FLORIDA MOUNTAINS FORMATION (CASSINIAN) OF WEST TEXAS AND NEW MEXICO

by

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CONTENTS

ABSTRACT

The cephalopod fauna of the Florida Mountains Formation (El Paso Group) is described and illustrated. The fauna is of Latest Canadian Age. Twelve of the species discussed are new, including the first representative of Manchuroceras in North America. The first known thin section of Catoraphiceras reveals short necks and thin, but layered rings.

INTRODUCTION

The Florida Mountains Formation (Upper Cassian), the highest unit of the El Paso Group, was named by Flower (1964) for exposures in the Florida Mountains, south of Deming, New Mexico. It is equivalent to Unit C, beds 1 through 6, of Cloud and Barnes (1946) and the trilobite fauna equates with that of zone J of Utah in the Wahwah limestone. Known exposures of the formation are few; at the type locality in the Florida Mountains, in the southern Franklin Mountains, El Paso, Texas, and at Beach Mountain, Texas.

The present study describes the cephalopod fauna from the El Paso and Florida Mountains localities. In both sections the formation is about 36 feet thick and contains beds of calcarenties. In the Florida Mountains these are interspersed with dark calcilutites and some thin beds, rarely exposed, of white-weathering calcilutites; in the Franklins, with abundant, orange-weathering silts and some beds of marly limestone and shale.

The contained fauna is large (see Flower, 1964, 1969 and LeMone, 1969) and consists of nautiloids, brachiopods, cystoid and crinoid fragments, a starfish, trilobites, gastropods, and sponges.

The cephalopods described below are from extensive collections made over the last 20 years by Drs. R. H. Flower and D. V. LeMone. Although not numerous at either locality, the nautiloids consist of representatives of the Baltoceratidae, Protocycloceratidae,

Proterocameroceratidae, Manchuroceratidae, Tarphyceratidae (?), Michelinoceratidae, and Troedssonellidae. The following forms are herein described:

Rhabdiferoceras (?) franklinense, n. sp.
Protocycleceras elongatum, n. sp.
P. keadyi, n. sp.
P. laswelli, n. sp.
P. rhabdiferum, n. sp.
P. russelli, n. sp.
P. spp.
Kyminoceras kottlowskii, n. sp.
Catoraphiceras sinuatum, n. sp.
C. staceyi, n. sp.
C. sp.
Clitendoceras (=Kirkoceras) ? sp.
Manchuroceras lemonei, n. sp.
Family Tarphyceratidae (?)
Michelinoceras floridaense, n. sp.
M. (?) melleni, n. sp.
Buttsoceras adamsi, (Butts) (?)
B. novemexicanum, Flower
B. williamsi, Flower
B. sp.

Some surprises have come from this study. The Endoceratida, the dominant cephalopod in the El Paso Group from the Middle Canadian on, are represented by only two specimens. One, a small siphuncle proves to be the first representative of Manchuroceras in North America; the second, tentatively identified as Clitendoceras, is a genus not previously known to occur above the Demingian. The Tarphyceratida, also dominant in the Middle-Upper Canadian, are known only from a few fragments. The apparent siphonal lining in Michelinoceras (?) melleni indicates that this may, indeed be an archaic structure in the Michelinoceratida. And, the preliminary indication from these described specimens is that the cephalopod species from the Franklins are distinct from those of the Floridas.

Taxonomic treatment has been conservative throughout. The cephalopods are not numerous, most are small and largely fragmentary. Recrystallization of cameral and siphonal deposits has made their interpretation ambiguous and raised many questions that could not be answered by the present material. Many forms suggested the desirability of erecting new genera; but, such descriptions are withheld for the present.

The Troedssonellidae are here retained in the Order Michelinoceratida. Teichert (1967) wanted to remove them to the Endoceratida on the basis of their stratigraphic occurrence and because he found it "...difficult to conceive of the Troedssonellidae as an ancestral or archaic group of the (Michelinoceratidae)..." This suggestion was, however, invalid before it was made: Flower (1962A) had already described Michelinoceras primum, the earliest known member of the Michelinoceratida from beds below those containing Buttsoceras. Subsequently, Flower (personal communication) has discovered poorly preserved, silicified Michelinoceroids in beds approximately 200 feet below the M. primum horizon.

ACKNOWLEDGMENTS

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Most of all I would like to thank Dr. Flower for his continued guidance and support. How he ever managed to put up with me (without at least getting coffee under his door) during this, my first, albeit blundering, assault on the cephalopods is beyond me.

SYSTEMATIC DESCRIPTIONS

ORDER ELLESMEROCERATIDA

Family Baltoceratidae

Rhabdiferoceras (?) *franklinense*, n. sp.
Pl. 1, figs. 1-5

Rhabdiferoceras (?) *franklinense* is known from a single internal mold, 29 mm long. The weathered ventral surface of the holotype shows a smooth orthocone with straight, transverse sutures interrupted by the more resistant, rod-strengthened siphuncle. The shell is initially depressed in section; the apical cross section (Pl. 1, fig. 5) has a height of 5.0 mm and a width of 5.5 mm. Unfortunately, at the oral end, only the siphuncle remains; however, in the thin section (Pl. 1, fig. 1) the vertical diameter of the shell is 7.3 mm, at a distance of 20 mm from the apical end.

The siphuncle is of moderate diameter (0.25 to 0.3 of the conch diameter) and removed from the venter by less than one fourth its diameter. Apically, the siphuncle is depressed in section, measuring 1.5 mm by 1.0 mm; adorally, it is circular, 2.3 mm across. Siphuncle segments are tubular and about as broad as long. Septa are unusually flat; throughout, three camerae occupy a length equal to the adoral shell diameter.

Thin episeptal deposits line all the septa and thicken against the mural part of the septum. Recrystallization is so advanced that one cannot be certain that some inorganic calcite, as a complemental

filling of an incomplete internal mold is not involved; but the uniform thinning of the mural deposits adorally suggests that only organic structures are involved.

The siphuncle wall is composed of short, but not vestigial, necks and relatively thin, homogeneous rings. A rod of clear calcite lies against the ventral wall of the siphuncle and thins orad. Apicad, the rod almost fills the siphuncle; orad, about a third of it. In vertical section the dorsal surface of the rod is almost straight, being only faintly undulating.

Discussion: This specimen differs appreciably from the genotype of Rhabdiferoceras, R. annuliferum Flower, in having short, not vestigial, necks; rather thin, homogeneous rings; and tubular rather than slightly convex siphuncle segments. It differs also in having a depressed section; but, for at least the siphuncle, the cross section changed during ontogeny to circular. Since R. (?) franklinense represents an earlier growth stage than the genotype, this difference may be more apparent than real.

R. (?) franklinense is most like a badly weathered specimen from the highest El Paso (Florida Mountain Formation) that Flower (1964) described as Cyptendoceras sp. The only difference between the two is that the septa of Cyptendoceras sp. describe broad, shallow, ventral lobes. These two specimens should most probably be separated into a new genus within the Family Baltoceratidae.

Type and Occurrence: Holotype, New Mexico Bureau of Mines and Mineral Resources (NMBM) No. 1638. From near the crest of the Scenic Drive, at the southern limit of the Franklin Mountains, El Paso, Texas.

Family Protocycloceratidae

Protocycloceras elongatum, n. sp.
Pl. 2, figs. 15-20

Protocycloceras elongatum is long, very slender, weakly annulated orthocone. The holotype (Pl. 2, figs. 19, 20) is an imperfectly silicified, badly weathered phragmocone approximately 50 mm long in which the protoconch is preserved. The protoconch is a very rapidly expanding cone, about 3 mm long.

The shell is circular in section and initially expands very rapidly at an angle of 34 degrees. The rapid expansion ceases after 3 mm and the remainder of the shell expands at an angle of less than 5 degrees. A cross section taken 40 mm from the apical end shows the shell to have a small, circular, subcentral siphuncle. Here the shell is 4.8 mm in diameter, while the siphuncle is 1 mm across and 1.5 mm from the venter.

Although impossible to determine much about the septa, the two that are exposed apically show very little curvature. Otherwise, details of internal morphology are unknown.

A paratype (Pl. 2, figs. 15-18) is a portion of a phragmocone 8 mm long. The specimen has four camerae whose sutures are directly transverse. The shell is circular and measures 3.5 mm in diameter basally and 4 mm orally. The oral cross section shows a circular siphuncle, 0.8 mm across and 1.2 mm from the venter.

Discussion: Protocycloceras elongatum is unique in having its protoconch preserved, the first such structure to be observed in Protocycloceras. Among it contemporaries, P. elongatum must rank as the most slender form and among the smallest in diameter.

Since the cross section of the holotype showed such poor preservation, a thin section was not attempted. Instead, it was coated with wax and matrix removed by a weak solution of acetic acid. Unfortunately, silicification was poor and the holotype is now three, very fragile segments, aggregating about 40 mm of length including the protoconch. However, as result of this it was possible to identify the paratype with the most oral fragment. Otherwise, the paratype would probably have been put in a species of its own. Microscopic examination of residues should yield further specimens.

Types and occurrence: Holotype, NMBM No. 1654; Paratype, NMBM No. 1655. Both are from the southern Franklin Mountains, above the Scenic Drive, El Paso, Texas.

Protocycloceras keadyi, n. sp.
Pl. 2, figs. 1-14

Protocycloceras keadyi is a small, slender species characterized by a depressed cross section and a ventral rod in its siphuncle. Annuli are low, transverse, and rather distant. The siphuncle is moderate in size (about 0.3 of the shell diameter), depressed in section, and in contact with the venter. Septa are flat and spaced closer together than annuli. Episeptal deposits are thin in the known specimens, which represent only adoral portions of phragmocones. Necks are short and straight and rings, thin and homogeneous.

The holotype, NMBM No. 1643, (Pl. 2, figs. 1-5) is a portion of a slender phragmocone 39 mm long. The shell is depressed in section and expands in a length of 32 mm from 5 by 4 mm to 9.5 by 8 mm. Annuli are low, transverse, and distant, four occupying a length equal to the adoral, horizontal diameter. Septa, as seen on the weathered dorsum (Pl. 2, fig. 2), are closer than annuli, five in a length equal to the adoral, horizontal diameter, and have only very slight curvature.

A cross section 26 mm from the apical end (Pl. 2, fig. 4) shows the siphuncle in contact with the venter. Here, both shell and siphuncle are depressed, measuring 9 by 7 mm and 2.5 by 2 mm, respectively.

A vertical thin section (Pl. 2, fig. 5) through the adapical 26 mm of the specimen confirmed the presence of the ventral rod in the siphuncle. The rod appears as crescent-shaped, clear calcite half filling the siphuncle in the cross section (Pl. 2, fig. 4). Necks are short and straight; rings,

thin and homogeneous. Thin episeptal deposits line all but the most adoral septa.

A paratype, NMBM No. 1644, (Pl. 2, figs. 11-14) is a portion of a phragmocone at about the same growth stage as the holotype. It is 38 mm long and depressed in section, measuring 4.5 by 4 mm apically and 10 by 7.5 mm orally. A septal view 4 mm from the apical end (Pl. 2, fig. 11) measures 5.0 by 4.6 mm and shows a siphuncle, whose boundaries are indistinct, in contact with the venter. Throughout its length five camerae and four annuli occupy a length equal to the adoral, horizontal diameter.

A second paratype, NMBM No. 1645, (Pl. 2, figs., 6-10) is a portion of a silicified phragmocone 26 mm long representing a somewhat later growth stage than the preceding specimens. It is incomplete apicad where only the vertical diameter of 4 mm could be measured. The cross section at the anterior end of the specimen (Pl. 2, fig. 9) has a horizontal diameter of 9 mm and a vertical diameter of 7.5 mm. Here, the siphuncle is essentially circular, 2.5 mm across, and in contact with the venter. Throughout its length five camerae and four annuli occupy a length equal to the adoral, horizontal diameter.

The vertical thin section (Pl. 2, fig. 10) is almost identical to that of the holotype. It shows a clear calcite rod in the siphuncle, which is thinner than that of the holotype, orad filling less than half the siphuncle, flat septa, thin episeptal deposits, short, straight necks, and thin, homogeneous rings.

Discussion: This species was placed in the genus Protocycloceras on the basis of its ventral rod, a structure unknown in any of the other genera of the Protocycloceratidae. It is possible, though, that portions of phragmocones sufficiently orad to show neither rod nor cameral deposits could be misassigned to another species of Protocycloceras or even to Kyminoceras. Although the rod is a diagnostic feature of the species, its other features, notably, depressed section, siphuncle in contact with the venter, relative spacing of annuli and camerae, and flat septa, should be distinctive enough for proper generic and specific assignment.

Flower (1964) was the first to recognize ventral rods in Protocycloceras. It is reassuring to note that this is a rather common structure. It further supports the view that the Protocycloceratidae, as presently conceived, is polyphyletic in origin, with forms with ventral rods being derived through the Baltoceratidae and those with empty siphuncles, through a general line of annulated shells.

Occurrence: All three specimens were collected in the southern Franklin Mountains above the Scenic Drive, El Paso, Texas.

Protocycloceras laswelli, n. sp.
Pl. 1, figs. 13-20

Protocycloceras laswelli is known from a single, silicified, incomplete phragmocone 22 mm long, depressed in section, increasing from 11.5 by 9.0 mm apically, to 13.0 by 11.0 mm orad. The specimen shows seven conspicuous, transverse annuli; four annuli occur in a length equal to the adoral shell diameter. A cross section (Pl. 1, fig. 18, 19) taken 16 mm from the apical end of the specimen shows a siphuncle of moderate size (0.3 of the shell diameter) in contact with the venter. Both the siphuncle and the shell are depressed in section, measuring 3.5 by 3.0 mm and 12.5 by 10.0 mm, respectively.

A vertical thin section (Pl. 1, fig. 20) of the apical 16 mm revealed short, straight necks and thick, layered rings. The rings have three layers: an inner and outer dark layer sandwiched around a light, more crystalline layer. Septa are largely destroyed, but those remaining show very little curvature. Siphuncle segments are tubular and half again as broad as long. Calcite within the siphuncle and camerae is badly recrystallized; cameral and/or siphonal deposits cannot be conclusively demonstrated.

Discussion: This species was assigned to Protocycloceras rather than Kyminoceras (see Teichert and Glenister, 1953) on the basis of its thick, layered rings. It differs also from the typical Kyminoceras in having a siphuncle somewhat larger in proportion to the shell diameter.

Although not quite as slender, it resembles P. keadyi. Once again, the rings provide the major difference; and, neither cameral nor siphonal deposits can be conclusively demonstrated in P. laswelli.

Type and occurrence: Holotype, NMBM No. 1642. From above the Scenic Drive in the southern Franklin Mountains, El Paso, Texas.

Protocycloceras rhabdiferum, n. sp.
Pl. 5, entire

Protocycloceras rhabdiferum is known from three, dorsally-weathered phragmocones, which are now thin sections. The species is characterized by a ventral rod, a moderately large, circular siphuncle slightly removed from the venter, thin episeptal cameral deposits that completely fill the portion of the camerae between siphuncle and venter, short necks, and thin, homogeneous rings.

The holotype, NMBM No. 1646, (Pl. 5, figs. 1-4) at first appeared to be too badly weathered to be of any significance. Unexpectedly, it made a spectacular thin section (Pl. 5, fig. 3, 4) in which rod and cameral deposits show up stark white against a background of black matrix.

The thin section reveals twenty camerae in a length of 34 mm. Annuli are distant and so low as to be inconspicuous. Spacing of camerae and annuli are not the same, four camerae occupy the same length that three annuli do. Septa are almost flat and are covered with thin episeptal deposits that thicken toward the siphuncle and, of course, thin orad.

The siphuncle is slightly removed from the venter; apicad, it is 1.0 mm across and 0.5 mm from the venter, while orad it is 2.5 mm across and 0.8 mm from the venter. The orad cross section (Pl. 5, fig. 1) is incomplete, but apparently circular, 9.0 mm across, and shows the siphuncle slightly depressed, 2.6 mm by 2.5 mm. The siphuncle wall is composed of short necks and thin, homogeneous rings.

The rod, in thin section (Pl. 5, figs. 3, 4), completely fills the siphuncle apicad and thins to a feather's edge orad. Its dorsal surface is a gently undulating curve.

Coarse, white calcite fills the space between the siphuncle and the venter. Presumably, it is recrystallized cameral deposits, since it is structurally the same as that in the rod and no evidence of the ventral portion of the septa can be seen in it.

Spacing of septa is not uniform, especially in the early stages where they tend to be farther apart than in later, more mature growth stages.

A paratype, NMBM No. 1647, (Pl. 5, figs. 5-7) is a portion of a phragmocone approximately 50 mm long that shows essentially the same features as the holotype. A thin section 32 mm long (Pl. 5, fig. 7) shows considerable variation in spacing of septa, especially apicad, where they are widely spaced. Extensive replacement has made the rod difficult to see, but its dorsal surface is delineated by a thin, white line, which separates organic calcite from matrix.

A cross section at the oral end of the thin section (Pl. 5, fig. 6) shows the shell, incomplete dorsally, 8 mm in width, with a siphuncle, depressed in section, slightly removed from the venter. The siphuncle measures 3.3 by 3.0 mm and is 0.7 mm from the venter. The rod fills about two thirds of the siphuncle and has a convex dorsal surface.

A second paratype, NMBM No. 1648, (Pl. 5, figs. 8-14) is a dorsally weathered phragmocone 60 mm long. In thin section

(Pl. 5, fig. 10), cameral deposits can be seen to precede the rod in development.

From its cross section (Pl. 5, Figs. 12, 13) it was originally thought to have two rods: one dorsal, the other ventral. Both these "rods" turned out to be adventitious: the cross section had intersected two pods of inorganic calcite (Pl. 5, fig. 14). The real rod was not discovered until the specimen was sectioned longitudinally.

The siphuncle (Pl. 5, figs. 12, 13) is depressed in section, having a width of 2.5 mm and a height of 3.0 mm. However, much of this seems to have resulted from compression during fossilization.

Again, there is variation in the spacing of the septa; camerae with the greatest length appear about midlength.

Discussion: These specimens were originally assigned to P. keadyi on the basis of their ventral rods. However, the differences between these specimens and P. keadyi proved to be greater than that allowed for in individual variation, especially since the growth stages are approximately equivalent. The most obvious differences are in regard to the shape of the rod in cross section, the relative size and position of the siphuncle, and the spacing of the septa. For the present, assignment of other specimens to P. rhabdiferum can only be made on the basis of vertical thin section.

Occurrence: All three specimens are from above the Scenic Drive in the southern Franklin Mountains, El Paso, Texas.

Protocycloceras russelli, n. sp.
Pl. 1, figs. 8-12

Protocycloceras russelli is a rather distinct, slender annulated orthocone, which at present is known from only one internal mold. The section is circular throughout, increasing in diameter from 5 mm to 8.5 mm over its 26 mm of length. The shell is initially straight, then becomes faintly exogastric. Over a length of 19 mm the shell expands slowly and conically from 5 mm to 7 mm in diameter; over the remaining 7 mm the shell has a noticeable exogastric curvature and increases in diameter to 8.5 mm.

Annuli are low and round; fifteen occur over its length. Adorally, four annuli occur in a length equal to the adoral shell diameter; apically, this figure is three and a half. Spacing of annuli is believed, on the basis of numerous breaks along septal surfaces, to correspond directly to the spacing of the septa.

Apically, the siphuncle is circular, 1.25 mm across and 1.0 mm from the venter. Fifteen millimeters farther orad, along a septal surface, the shell is 6 mm across and the siphuncle, which has a diameter of 1.5 mm, is just slightly more than one millimeter from the venter. This and other septal surfaces (Pl. 1, figs. 11, 12) show that the curvature of the septa is slight.

Discussion: Protocycloceras russelli is unique among the Florida Mountains cephalopods in developing exogastric curvature anteriorly. In separating it from other annulated species, reliance was placed on its

circular section, and small, circular, subventral siphuncle. Details of its internal morphology are at present unknown.

Type and occurrence: Holotype, NMBM No. 1639. From the east side of the Florida Mountains, south of Deming, New Mexico.

Protocycloceras spp.
Pl. 1, figs. 6, 7

Under this designation are described two specimens exposed as natural, essentially horizontal sections through both phragmocone and living chamber. Although both specimens are of approximately the same size, they differ in proportions and are, undoubtedly, two different species.

Protocycloceras sp. (1), NMBM No. 1640, (Pl. 1, fig. 7) is an annulated orthocone, 47 mm long. Annuli are prominent, low, and rounded. Adorally, three and a half annuli occupy a length equal to the adoral shell diameter; apically, four do.

The phragmocone has a maximum length of 30 mm and expands conically from 6 mm to 10 mm. The living chamber has a maximum length of 19 mm and is tubular, 10 mm across. It should be noted in regard to these measurements that the plane of the section exposes the siphuncle and is, therefore, below the plane of maximum width.

Spacing of the septa corresponds to that of the annuli; the septa join the shell wall at the midpoint of the concave interspaces. Curvature of the septa is at least equal to the length of a camera.

The siphuncle is central throughout, no more than 2 mm across. Calcite in camerae is mainly inorganic, as shown by its absence except for one small area seen in the lower left of Pl. 1, fig. 7 in the apical camerae. Calcite in the siphuncle is probably inorganic, but apical segments where organic deposits might be expected are not exposed.

Protocycloceras sp. (2), NMBM No. 1641, (Pl. 1, fig. 6) is an annulated orthocone 50 mm in length. The septate portion of the shell is 30 mm long and expands more rapidly than in the previous specimen, from 4 mm apically to 8 mm at the base of the living chamber. Also, unlike the previous specimen, the living chamber expands conically from 8 mm to 10 mm over a length of 20 mm.

Annuli, which are not as prominent or rounded, are variable in spacing. The number of annuli in a length equal to the adoral shell diameter increases apicad, from four and a half in the living chamber to five at midlength and five and a half farther apicad.

Spacing of the camerae is closer and more variable than in the previous specimen and does not necessarily correspond to the spacing of the annule. Curvature of the septa is slight, equal to less than half the length of a camera.

The siphuncle is exposed throughout the length of the phragmocone and apically is closer to the right shell wall; farther orad it is central. Siphuncle segments are broader than high.

Discussion: Although obvious that these are two distinct species, it is impossible to place them in any of the other described species. Without knowledge of at least their cross sections it would be dubious at best to base new species on them.

However, they are important in that they do show the approximate proportions of the living chamber in relation to the rest of the shell.

Figured Specimens: NMBM No. 1640, from the southern Franklin Mountains, above the Scenic Drive, El Paso, Texas. NMBM No. 1641, from the east side of the Florida Mountains, south of Deming, New Mexico.

Kyminoceras kottlowskii, n. sp.
Pl. 3, figs. 4-8; Pl. 4, figs. 1-4, 9-12

Kyminoceras kottlowskii is a prominently annulated orthocone of circular section that has a small, circular siphuncle slightly removed from the venter. Spacing of annuli exactly corresponds to that of the camerae. Siphuncle segments are tubular, longer than broad. Septa are straight and inclined apicad between venter and siphuncle; between siphuncle and dorsum they have moderate curvature. Both siphuncle and camerae are apparently devoid of organic deposits.

The holotype, NMBM No. 1649, (Pl. 3, figs. 4-10) is a portion of a phragmocone 27 mm long, embedded in matrix. The shell is circular in section and increases in diameter from 6 mm, 2 mm from the apical end, to 7.5 mm, 19 mm farther orad. The siphuncle is small (about .2 of the shell diameter), circular, and removed from the venter by a distance equal to its diameter; apicad, it is 1.3 mm across, orad, 1.5 mm across.

Orad, three camerae and three annuli occupy a length equal to the adoral shell diameter. About midlength there is a break in the pattern and the septa, instead of joining the venter in the center of each concave interarea, become farther apart, two and a half camerae in a length of three annuli. Apicad, the pattern of spacing becomes three and three again.

The siphuncle wall is composed of short necks and thin rings. Siphuncle segments are about one and a half times longer than broad.

The calcite that completely fills the siphuncle is invaded from both ends by matrix and is most probably adventitious.

Septa are straight and inclined apicad between venter and siphuncle. Between siphuncle and dorsum the septa are curved, curvature equal to less than half the length of a camerae. The ventral portion of all but the most orad camerae is completely filled by calcite. Since this calcite swings around and covers the entire dorsal wall of the siphuncle, it, too, is adventitious.

A paratype, NMBM No. 1650, (Pl. 4, figs. 1-3) shows some variation in spacing of annuli and is not as slender. Over a length of 23 mm it increases in diameter from 5 mm to 8 mm, while the siphuncle, whose segments are broader, increases from 1.2 mm to 1.8 mm over the oral 17 mm of the specimen. Annuli and camerae correspond in spacing; throughout four occupy a length equal to the adoral shell diameter. No cameral or siphonal deposits are evident.

A third specimen, NMBM No. 1652, (Pl. 4, figs. 10-12) is tentatively assigned to K. kottlowskii on the basis of its thin section (Pl. 4, fig. 12), which shows the same internal morphology as the holotype and paratype. It differs though, in having a depressed cross section (Pl. 4, figs. 9, 11). This specimen is an internal mold 22 mm long in which neither cameral nor siphonal deposits are evident. Apically, its cross section measures 4.0 mm by 3.4 mm and has a circular siphuncle, 0.8 mm across, removed from the venter by one half its diameter; orally, it has a width of 6.0 mm and an estimated height of 5.7 mm, and a siphuncle, 1.4 mm across. Three annuli and three

camerae are found in a length equal to that of the adoral, horizontal diameter.

Discussion: The distinction between Protocycloceras and Kyminoceras is not alto gether clear. The Treatise (Teichert et al., 1964) indicates that the only real difference is in siphuncle size. Kyminoceras has a siphuncle that is about two-tenths the size of the corresponding conch, Protocycloceras, about three-tenths. While this difference is not profound, e. g., a form with a small siphuncle, but thick rings would have to be placed in Protocycloceras, it does give at least a limited basis for separation. For this reason, this species was placed in Kyminoceras.

In erecting this species reliance was placed more on stability of internal features, rather than variation in external features. Thus, variation in spacing of annuli is not deemed as important as correspondence in spacing of annuli and camerae. One problem still remains, that of cameral and/or siphonal deposits. While K. kottlowskii must have had some means of hydrostatic balance, no specimen has yet been found that is sufficiently apicad to show what it was.

Occurrence: All three specimens are from the east side of the Florida Mountains, south of Deming, New Mexico.

Catoraphiceras sinuatum, n. sp.
Pl. 2, figs. 21-23; Pl. 3, figs. 1-3

Catoraphiceras sinuatum is known from a single, annulated, internal mold 45 mm long. Annuli are very prominent, five occur in a length equal to the adoral horizontal diameter and are about the same size as the concave interspaces.

Sutures describe fairly broad, deep lobes on the venter. The one visible in the ventral view (Pl. 2, fig. 21) measures 5 mm wide and 4 mm deep. It is difficult on this specimen to tell exactly what the sutures do laterally or on the dorsum, but they appear to be transverse laterally.

Both shell and siphuncle are depressed in section. Apically, the shell has a horizontal diameter of 18 mm and a vertical diameter of 12.5 mm. Orad, a distance of 39 mm, these diameters are 20 mm and 18 mm, respectively. The siphuncle, which is only slightly removed from the venter, measures 5.5 mm by 5 mm, apically and 7 mm by 6 mm, orad.

A vertical thin section (Pl. 3, fig. 1) was made through the apical 25 mm of the specimen. Although septa were largely destroyed by invading sediments, many necks and rings remain. Necks are short, extending about one-third the length of a segment, and are slightly curved, convex side out. Rings are thin, but can be differentiated into an inner, thin opaque layer and an outer, thicker, light, granular zone. Thickening of the ring apicad in some segments is adventitious. Taken

together, the necks and rings have a sinuous outline, convex in the region of the neck, concave apicad.

Cameral and siphonal deposits are wanting, possibly because this portion of the phragmocone is too far orad to have developed them.

Discussion: This specimen is one of the more significant in the collection because of the information provided by its thin section. Thus far, this is the only known thin section of the genus Catoraphiceras. At the very least it provides us with additional information about only one species; whether the short necks and think layered rings are typical remains to be seen.

Type and occurrence: Holotype, NMBM No. 1657, from the east side of the Florida Mountains, south of Deming, New Mexico.

Catoraphiceras staceyi, n. sp.
Pl. 2, figs. 28-31

Catoraphiceras staceyi is known from numerous, single camerae etched from blocks of limestone and from the lone, silicified phragmocone described below.

The phragmocone is 29 mm long and is covered with low, rounded, transverse annuli, Concave interareas are about the same size as the convex annuli and orad, where they are best preserved, are about 1 mm apart. Throughout, there are three annuli in a length equal to the adoral, horizontal shell diameter. Sutures describe narrow, fairly deep, rounded lobes on the venter (Pl. 2, fig. 28), broad, shallow saddles laterally (Pl. 2, fig. 29), and broad, shallow lobes on the dorsum (Pl. 2, fig. 30).

Camerae are short. About midlength where they are exposed on the dorsum they are 1 mm long. Here, approximately five camerae are found in a length equal to the adoral, horizontal shell diameter.

The shell is depressed in section. Apically, it measures 5 by 4 mm; adorally, 8 by 7.5 mm. The siphuncle, which can only be seen in the anterior view (Pl. 2, fig. 31) is small, submarginal, and circular, 1.5 mm across. Details of internal morphology are unknown.

Discussion: To judge by the number of single, silicified camerae of assorted sizes found after etching, C. staceyi was one of the most abundant cephalopods in the El Paso region during late Cassian time. Unfortunately, the holotype is the only phragmocone known at present.

Since it is too fragile to section, details of its internal morphology will have to await discovery of good sectionable material.

Type and occurrence: Holotype, NMBM No. 1652. From the east side of the southern Franklin Mountains, above the Scenic Drive, El Paso, Texas.

Catoraphiceras sp.
Pl. 2, figs. 24-27

The only known specimen of Catoraphiceras sp. was an internal mold 21 mm long that was destroyed in grinding a thin section. Eight very low, transverse annuli separated from one another by pencil-thin interareas cover the adoral 18 mm of the shell. Four annuli occur in a length equal to the adoral shell diameter.

The shell is depressed in section and increases in diameter from 6 mm to 8 mm horizontally and from 5.5 mm to 7.5 mm vertically. The siphuncle is also depressed in section and orad measures 2.3 mm by 2 mm. The siphuncle is only slightly removed from the venter, being less than 0.5 mm away, orad.

Sutures describe a shallow, angular lobe on the venter, a broad, shallow lobe on the dorsum, and broad, shallow saddles laterally (Pl. 2, figs. 24-26).

Details of internal morphology are unknown.

Discussion: With so little known about the internal morphology of Catoraphiceras, it seems almost tragic that of all the thin sections cut, this was the only one ground into oblivion. Be that as it may, this species is distinctive and easily recognized on the basis of its external morphology alone; it is hoped that collections made in the near future will provide material adequate for erecting a new species.

Figured Specimen: NMBM No. 1653. From the east side of the Florida Mountains, south of Deming, New Mexico.

ORDER ENDOCERATIDA

Family Proterocameroceratidae

Clitendoceras (=*Kirkoceras*) ? *sp.*
Pl. 6, figs. 1-6

This genus is represented by a portion of a silicified endosiphuncle 27 mm long. The siphuncle is initially blunt, expanding very rapidly for a distance of approximately 8 mm, after which the expansion slows and becomes essentially conical, expanding at an angle of 15° horizontally and 17° vertically. The specimen is compressed in section: 14 mm from the apical end (Pl. 6, fig. 6) the horizontal diameter measures 10.5 mm and the vertical 11.0 mm, while 19 mm from the apical end (Pl. 6, fig. 4) these diameters measure 12.5 mm and 13.0 mm, respectively.

The siphuncle is only faintly endogastric. In profile (Pl. 6, fig. 2) both the venter and the dorsumare initially convex, the venter becomes straignt after a length of 3 mm, the dorsum, after 8 mm. Also in profile, two very faint oblique ridges near the apical end of the specimen can be seen sloping apicad from the venter making an angle of 57° with respect to the venter. These ridges may represent the septal ridges. Very fine longitudinal markings of unknown origin, best seen in the dorsal and lateral views (Pl. 6, figs. 2, 3) cover its surface.

The apex of the siphuncle shows a quadrate fracture pattern that apparently follows the internal blade pattern. The fractures make angles of approximately 45° with respect to the sagital plane.

A cross section taken 14 mm from the apical end of the siphuncle (Pl. 6, fig. 6) reveals a crescent-shaped tube, dorsad of center, and remnants of two dorso-lateral blades. The absence of the ventro-lateral blades is the result of either ontogenetic change in the blade pattern or destruction during recrystallization.

Discussion: Flower (in manuscript) restricts the genus Clitendoceras (=Kirkoceras) to faintly endogastric enoceroids with slender ventral siphuncles, round or compressed in section, with endosiphuncles that show considerable variation: the tube may lie dorsad of or at the center and may be circular, depressed, or compressed; cones may be simple or extended forward dorsally; blades that show three blade patterns (which may form an ontogenetic sequence) (1) horizontal; two blades, (2) trifid, with median dorsal blades and two ventral blades, and (3) two vertical blades. He has further found that Clitendoceras is confined to the Demingian (zones E-G_1).

The figured specimen, then resembles Clitendoceras in gross aspect only; that is, it is faintly endogastric, compressed in section, and, as in the genotype (Ulrich and Foerste, 1935), has a nearly straight ventral profile with a convex dorsum. It differs markedly in being more robust, in having a crescent-shaped tube and a quadrate blade pattern, and in coming out of the Cassinian (zone J).

This specimen may be the apical end of a relatively large form, if not, perhaps a new genus. The fine longitudinal markings are unknown elsewhere on siphuncle surfaces of Clitendoceras.

Figured Specimen: NMBM No. 1625. From the east side of the southern Franklin Mountains, above the Scenic Drive, El Paso, Texas.

Family Manchuroceratidae

Manchuroceras lemonei, n. sp.
Pl. 6, figs. 7-13

Manchuroceras lemonei is represented by a single, silicified endosiphuncle approximately 38 mm long. Its apical end was not preserved and a small portion of the oral end was destroyed in preparation.

The endosiphuncle initially expands very rapidly, vertically at an angle of 42° and horizontally at 49°. This rapid expansion abruptly decreases after a length of 13 mm to approximately 12° both vertically and horizontally. Apically, the natural, weathered cross section (Pl. 6, fig. 13) is circular, 7 mm across. Adorally, it is depressed in section with a width of 20.1 mm and a height of 18.2 mm at a length of 27 mm as measured on the dorsum.

The surface of the endosiphuncle (Pl. 6, figs. 7-9, 13) is completely covered with septal ridges that slope apicad from the ventral at an angle of 44° with respect to the ventral profile. The ridges are sharp and narrow ventrally; low, broadly rounded dorsally, their margins indistinct, and they are transverse as they cross the dorsum and chevron shaped on the venter. There are eight septal ridges in a length equal to the adoral height and over the entire length of the specimen there are thirteen septal ridges.

Midventrally the ridges split and anterior and posterior margins bound strongly flattened areas. The venter, then, is marked by a narrow, flat zone that, presumedly, was in contact with the conch.

The endosiphocone (Pl. 5, fig. 12) is depressed in section, is concave dorsally, and terminates dorsad of center, approximately 12 mm from the apical end of the specimen. At a distance of 23 mm from the apical the height of the endosiphocone is approximately 9 mm and the width, 12 mm, while the dorsal wall of the endosiphuncle measures 1.3 mm, the lateral 3.2 mm, and the ventral 7.3 mm. This ventral thickening is the result of a single, low, rounded, midventral ridge that tapers apically in width from 6 to 4 mm. This ridge makes the endocone concave ventrally, producing the crescent shaped cross section.

A cross section taken 13 mm from the apical end (Pl. 6, fig. 10, 11) proved to be most unrewarding. Here, the endosiphuncle is only slightly depressed in section, having a width of 16.2 mm and a height of 16.0 mm. Recrystallization is quite advanced and has obliterated structures in the ventral two thirds of the specimen. The dorsal one third shows only the sheaths of concentric endocones.

Discussion: The genus Manchuroceras, of which Liaotungoceras and Grabauoceras are junior synonymns, was first described by Ozaki (1927) and was based on an endosiphuncle from the Wolungian limestone (Upper Canadian) of Manchuria. Since then, nine species of Manchuroceras have been described from China (see Obata, 1939 and Chang, 1965), two from Tasmania (Teichert, 1947) and one (which does not belong) from Siberia (Balashov, 1962); and one unfigured and undescribed specimen has been listed as Liaotungoceras sp. among the Arenigian faunas of Argentina (Harrington and Leanza, 1957).

Manchuroceras lemonei marks the first reported occurrence of the genus in North America. The holotype differs in general from the described Asiatic species in being much smaller, more breviconic, broader in section, and by having a steeper angle at which the septal ridges slope apicad from the venter. It differs from the Tasmanian forms in having a steeper angle on the septal ridges and a blunter apex.

Type and occurrence: Holotype, NMBM No. 1624. From the east side of the southern Franklin Mountains, above the Scenic Drive, El Paso, Texas.

ORDER TARPHYCERIDA

Family Tarphyceratidae ?
Pl. 6, fig. 28

This is a rather poorly preserved, internal mold of a tarphycone with a maximum diameter of 36 mm. Little more than half the outer volution remains, of which two-thirds is living chamber, the remainder divided into six rather shallow camerae, no more than 2 mm long. Sections revealed that most of the chambered part of the shell, including the siphuncle, was gone; however, the living chamber was almost completely intact. The adoral end of the living chamber is compressed in section, having a height of 12 mm and a width of 10 mm, and has a shallow impressed zone, 1.5 mm high and 3 mm wide.

Discussion: As Flower (1968) noted, only fragments of coiled cephalopods have ever been found in the Florida Mountains Formation. This is the best of those fragments and is, yet, so incomplete that it is difficult even to place it in the proper family, much less the proper genus. On the basis of its compressed section and shallow impressed zone it was placed on the Family Tarphyceratidae. Without knowledge of the position of its siphuncle, this assignment is tentative at best.

Figured Specimen: NMBM No. 1636. From the east side of the southern Franklin Mountains, along Scenic Drive, El Paso, Texas.

ORDER MICHELINOCERATIDA

Family Michelinoceratidae

Michelinoceras floridaense, n. sp.
Pl. 8, entire

Michelinoceras floridaense is as yet known from only a single specimen, now a thin section, from the east side of the Florida Mountains, south of Deming, New Mexico. The holotype is a smooth orthocone, 47 mm long, with straight, transverse sutures. The shell is circular in section and increases in diameter from approximately 5 mm apically, to 8 mm orad. The siphuncle is small, circular, and slightly eccentric. A thin section made from the anterior 38 mm of the specimen shows the siphuncle increasing in diameter from 1.0 mm to 1.5 mm. Apically, it is approximately 2 mm from the venter and 2.5 mm from the dorsum; adorally, it is 3 mm from the venter and 3.5 mm from the dorsum.

Siphuncle segments are essentially tubular, although the dorsal side is slightly convex, and are about three-quarters as wide as long. Curvature of the septa is moderate, equal to approximately three-fifths the length of a camera. Apically, three camerae occupy a length equal to the adoral shell diameter. Adorally, this figure has increased to three and a half.

The ventral half of the camerae are filled completely by cameral deposits which are seen as coarse calcite. The dorsal half of the camerae show L-shaped, episeptal deposits that decrease in size systematically in an oral direction.

Septal necks are short and straight; necks, thin and homogeneous. Within the siphuncle annuli are seen to lie on the ventral ring and to grow forward from the region of the necks. Apicad, they have fused, forming a nonsegmental, ventral lining. The dark, organic-appearing material in the siphuncle is actually fine, granular, red matrix. The red appears black to the film, giving it an organic appearance.

Discussion: As originally defined (Foerste, 1932) Michelinoceras was used for generalized, smooth orthocones with simple sutures, and essentially tubular, empty siphuncles. Flower (1962a), after studying Barrande's illustrations, expanded the genus to include forms with annuli in the siphuncle and in which episeptal deposits were not markedly retarded. Using this expanded definition, this Cassinian form is a perfectly good Michelinoceras. However, with the exception of having no discernable hyposeptal deposits, M.floridaense, with its slightly expanded siphuncle and cameral deposits apparently preceding annuli in development, would also make a good Geisonoceras (see Sweet, 1964). The solution to this may well be, as Flower (1962b) suggested, that there is no good boundary between the two genera and that M. floridaense is a transitional form.

Type and occurrence: Holotype, NMBM No. 1635. From the east side of the Florida Mountains, south of Deming, New Mexico.

Michelinoceras (?) melleni n. sp.
Pl. 9, figs. 2-9

Michelinoceras (?) melleni is also known from only a single specimen, now two thin sections, from the east side of the Florida Mountains, south of Deming, New Mexico. The holotype is a slender, smooth orthocone, approximately 46 mm long, that has straight, transverse sutures. The shell is initially circular in section, expanding in diameter from 3 mm to 4.1 mm over the 19 mm of length of the apical thin section (Pl. 9, figs 6-8). Over the 25 mm of the adoral thin section (Pl. 9, figs. 5, 8) the shell's cross-section changes from circular to compressed. Apically, it is 4.3 mm across; adorally, it measures 6 mm vertically and 5.5 mm horizontally. Since the siphuncle is central throughout, orientation was difficult to determine. The apical thin section was cut first, under the assumption that the shell was compressed adorally. The distribution of cameral deposits substantiated this assumption and the adoral section was ground down to the same plane.

Siphuncle segments are about twice as long as broad and expand slightly into the camerae. There is a constriction at the foramina which makes the siphuncle fusiform in longitudinal section. In cross-section (Pl. 9, figs. 2, 4) the siphuncle is circular; maximum diameter occurs at mid-length in each segment. Maximum diameter increases from 0.8 mm in the apical camera to 1.4 mm in the oral camera.

Growth of camerae with respect to shell diameter is almost constant. The number of camerae occupying a length equal to the adoral shell diameter varies by only one-quarter of a camera, from two and a quarter to two and a half. Curvature of the septa is slight, equal to less than one-third the length of the camera.

Cameral deposits indicate an advanced stage of growth and are found throughout the length of the specimen. Ventrally, they completely fill the camerae; dorsally, lobate, L-shaped episeptal deposits fill progressively less and less of the adoral camerae. Hyposeptal deposits are not evident, though it is possible that the ventral deposits represent hypo- and episeptal deposits that have fused. Structural detail was lost during fossilization and the cameral deposits are now coarse, white calcite. Spaces within the camerae not filled by cameral deposits are now occupied by darker, more finely crystalline calcite and, to a much lesser extent, by matrix.

The siphuncle wall is composed of very short, straight necks and thin homogeneous rings. Structures within the siphuncle are rather difficult to interpret. In the apical end of the siphuncle there is a sinuous tube, matrix filled, lying close to or in contact with the dorsal wall. The tube is surrounded by coarse, white calcite and terminates in some fine, dark calcite after a distance of four camerae. Vestiges of the tube can be seen lying against the dorsal wall of the siphuncle in the adoral end of the second thin section. The initial termination of the tube is not a result of the tube piching-out, but

results from the plane of the section not coinciding with the plane of the tube. Just above this terminal point there is a joint fracture showing some offset; it is also at this point where the siphuncular calcite changes abruptly from coarse and white to fine and dark. This fine dark calcite is, then, interpreted to be of inorganic origin.

The evidence indicates that this tube is a real, organic structure (and not the work of the devil, as at first suspected.) The coarse, white, siphuncular calcite appears structurally related to that of the cameral deposits, and is, therefore, also taken to be of an organic nature.

These siphonal structures can represent one of at least two possibilities: first, a lining similar to that of Buttsoceras in which the tube has become sinuous; or, annuli that have fused and grown more rapidly on the ventral side of the siphuncle, producing the tube. Common sense would indicate that the former is the more likely possibility, since it is difficult to conceive of a specimen containing this many camerae, twenty-five in this case, in which annuli would fill the entire siphuncle. Whereas, it is not difficult to find specimens in which linings of the Buttsoceras-type have filled siphuncles of this length.

Discussion: This is a rather puzzling specimen. While it is obvious that M.(?) melleni is a Michelinoceroid, it is not altogether obvious in which of the various families--Troedssonellidae, Geisonoceratidae, or Michelinoceratidae--it more properly belongs.

However, M.(?) melleni seems more closely related to M. floridaense, particularly in regard to cameral deposits, than to any other described form. As such, it seems wiser to group it with a contemperaneous form, rather than to put it in an altogether different family on the basis of what may prove to be an incorrect interpretation of its siphonal structures.

Type and Occurrence: Holotype, NMBM No. 1636. From the east side of the Florida Mountains, south of Deming, New Mexico.

Family Troedssonellidae

Buttsoceras adamsi (Butts) (?)
Pl. 6, figs. 22-27

Orthoceras adamsi Butts, 1926, Geology of Alabama: Ala. Geol. Surv., Spec. Rpt. 14, p. 99, 160, pl. 22, fig. 22,23.
Buttsoceras adamsi Ulrich and Foerste, 1933, Science, n. ser., vol. 78, p. 288.

Here figured and described as B. adamsi ? are three etched, silicified specimens from the east side of the southern Franklin Mountains above the Scenic Drive, El Paso, Texas. Although differing in general proportions, they are all circular in section and possess small, central or slightly eccentric siphuncles.

The first, NMBM No. 1630 (Pl. 6, figs. 26,27) is a portion of a phragmocone 29 mm long that is circular in section. The shell diameter increases from 7mm to 9.5 mm over its length. The siphuncle is central and subcircular, measuring 1.5mm by 1 mm. Sutures are transverse and septa have a moderate curvature. Two and a half camerae occupy a length equal to the adoral shell diameter.

The second NMBM No. 1631 (Pl. 6, figs. 22-23), is also a portion of a phragmocone; this one is 27.5 mm long, circular in section, and possesses a small, central, circular siphuncle, 1mm in diameter. The shell expands from 4.5mm apicad to 6.5 mm orad. Throughout, two camerae occupy a length equal to the adoral shell diameter. Septa show moderate curvature and sutures are transverse.

The last, NMBM No. 1634 (Pl. 6, figs. 24, 25), is a septate shell, circular in section, 29 mm long, that increases in diameter

from 7 mm to mm. The siphuncle is small, circular, and eccentric, making it possible to orient this specimen. Apically, the siphuncle is 1 mm across, 2 mm from the venter, and 3 mm from the dorsum; orad, it is 1.5 mm across, 2.5 mm from the venter, and 4 mm from the dorsum. The surface of the shell is smooth and the sutures are transverse. Initially, the sutures appeared to form ventral saddles, but on closer examination it is apparent that the saddles are the result of imperfect silicification accentuated by differential etching. Throughout, two and one quarter camerae occupy a distance equal to the adoral shell diameter.

Discussion: Flower (1962) remarked that he thought B. adamsi was a "...single too-broadly-defined species;" an opinion to which I must concur. However, in the absence of further study of the type material, there is no other species in which to place a slender Buttsoceras with a small siphuncle.

Figured specimens: NMBM Nos. 1630, 1631, and 1634. All from the eastside of the southern Franklin Mountains, above the Scenic Drive, El Paso, Texas.

Buttsoceras novemexicanum Flower

Pl. 6, figs. 17-21; pl. 7, entire

Buttsoceras novemexicanum Flower, 1962, New Mexico Inst. Min. and Tech., State Bur. Mines and Mineral Res., Mem. 10, p. 5.

Two specimens, both from the east side of the Florida Mountains, which compliment one another are figured and described below. Both were encountered while trimming excess matrix off other specimens and are, thus, unhoped-for treasures.

The first NMBM No. 1632 (Pl. 6, figs. 17-21), is a portion of a phragmocone approximately 53 mm long. A portion of the specimen 31 mm long that terminates 4 mm from its apical end was sectioned to reveal a circular shell that expands in diameter from 12 mm to 13 mm. The siphuncle is large, circular, and eccentric: apically, it is 4 mm across, 3 mm from the venter, and 5 mm from the dorsum; adorally, it is 5.5. mm across, 3 mm from the venter, and 4.5 mm from the dorsum. A good part of the dorsal shell was apparently gone before burial; consequently, the camerae are filled with sediment, that, for the most part, destroyed the dorsal septa. The ventral septa have very little curvature and slope toward the siphuncle at an angle of 15 degrees. Two and three fourths camerae occupy a length equal to the adoral shell diameter. Cameral deposits are not well developed and preservation makes their interpretation ambiguous.

The siphuncle wall shows short necks and thin homogeneous rings. There is a slight constriction at the foramina that gives the siphuncle a gently fusiform aspect. The siphuncle segments are at least as broad as high.

A dorsal cavity, which oddly, increases in height apicad from 0.5 mm to 1 mm, traverses the entire length of the lining-filled siphuncle. Anteriorly, it is crossed by numerous diaphragms (Pl. 6, fig. 19); apically, it is sediment filled. In cross section (Pl. 6, figs. 17, 18, 20, 21) this cavity is crescent-shaped apically, 3 mm across, and figure eight-shaped orad, 2 mm across. Orally, a vertical portion separates the cavity into two subcavities, producing the figure eight shape. Also in cross section, some peculiar, v-shaped structures can be seen within the siphuncle, below the dorsal cavity. Preservation makes their interpretation ambiguous; but, since they are not well defined in all the cross sections, they are most probably adventitious.

In the vertical, opaque section (Pl. 6, fig. 19) the anterior portion of the lining is composed of polygonal bodies of white calcite, while the apical part of the lining is composed of coarsely crystalline, white calcite. These two textures have resulted from the two distinct periods of mineralization that can be interpreted from the reverse offsets on the joint set that can also be seen in the opaque section.

The second, NMBM No. 1633 (Pl. 7, entire) is a portion of a phragmocone, now a thin section, representing an earlier growth stage than the previous one.

The shell is essentially circular expanding in diameter from 5.4 mm to 7.0 mm over its length of 23 mm. The siphuncle is large, although not as large proportionately as the previous one, compressed in section, and eccentric. Apically, the siphuncle has a height of

1.8 mm, a width of approximately 1.5 mm, and is 1.6 mm from the venter adorally, the figures are 2.4 mm, 2.0 mm, 2.0 mm, and 2.6 mm, respectively. The siphuncle wall shows short necks and thin homogeneous rings. Siphuncle segments are tubular and longer than wide. Curvature of the septa is shallow, equal to less than half the length of a camera. Apically, two and a half camerae occupy a length equal to the adoral shell diameter, while adorally this figure increases to three.

Cameral deposits are well developed and are bilaterally symmetrical with respect to the venter (Pl. 7, fig. 1) and absent on the dorsum. Episeptal deposits are well developed; hyposeptal are wanting. The usual, symmetrical, orad decrease in the size of the cameral deposits is not evident in the thin section (Pl. 7, fig. 9) because the section is not vertical. The original saw cut (Pl. 4, fig. 5) necessitated a longitudinal section that is displaced some 40 degrees in a right lateral direction from the vertical.

The dorsal cavity is again crescent shaped and filled with matrix, while the lining is composed of polygonal bodies of white calcite.

Discussion: These specimens supplement Flower's original description of the species and show some of the individual variation that must be allowed within a species. Most notable among the variations is the crescent-shaped tube, which in the first specimen is

subdivided orad into two subcavities by growth of a vertical partition.

The unusual polygonal bodies that line the siphuncle of the second specimen (Pl. 7, fig. 1) were initially thought to be organic, similar to those of Bajkaloceras (Balashov, 1962). However, they proved to be a preservation phenomenon: as grinding of the longitudinal section progressed (Pl. 7, figs. 4, 7) they disappeared and no vestige of their structure can be seen in any of the enlargements of the thin section (Pl. 7, figs. 9, 10, 11).

Type and Occurrence: Hypotypes, NMBM Nos. 1632 and 1633. Both from the east side of the Florida Mountains, south of Deming, New Mexico.

Buttsoceras williamsi Flower
Pl. 6, figs. 14-16; Pl. 9, fig. 1

Buttsoceras williamsi Flower, 1962, New Mexico Inst. Min. and Tech., State Bur. Mines and Mineral Res., Mem. 10, p. 4.

Two specimens of Buttsoceras williamsi, both from the southern Franklin Mountains at El Paso, Texas, are figured and described.

The first, NMBM No. 1626, (Pl. 9, fig. 1) is a portion of a phragmocone 185 mm long exposed as a naturally weathered, horizontal (?) section. Although difficult to orient the specimen, it is assumed that it was buried with its heavier, ventral side down and that the dorsal side was eroded away, exposing the siphuncle.

The shell expands from a diameter of 9 mm apically to 18 mm adorally, while the siphuncle, which is central, expands from 3 mm to 9 mm. The shell is septate throughout; the septa form 35 camerae. Apically, two camerae occupy a length equal to the adoral shell diameter; adorally, three camerae occupy a corresponding length. Throughout its length siphuncle segments are slightly broader than long. The curvature of the septa is shallow, equal to slightly less than half the length of the camera. About midlength the siphuncle has been breeched, exposing the tube within the lining. Unfortunately, nothing can be seen of the exterior features of the conch.

The second, NMBM No. 1627 (Pl. 6, figs. 14-16), is also a portion of a weathered, silicified phragmocone. This one, however, has been freed from its matrix.

The conch is smooth externally and is essentially tubular, expanding only 1.5 mm in a length of 40 mm, from 12.5 mm to 14.0 mm. Sutures are straight and transverse and are spaced approximately 4 mm apart. There is only a slight variation in this spacing, with the third and fourth sutures from the apical end spaced about 3.5 mm apart.

The siphuncle expands from 5.5 mm to 6.0 mm and is eccentric; adorally, it is 4 mm from the venter and 6 mm from the reconstructed dorsum. Siphuncle segments are tubular and at least as broad as high. Curvature of the septa is again shallow, equal to less than half the length of the camera. 3-1/3 camerae occupy a length equal to the adoral shell diameter. The septa are more steeply inclined on the more ventral side of the siphuncle and become transverse as they approach the siphuncle. Cameral deposits can be seen to fill the ventral half of the shell. In cross-section the shell wall appears to be thickened ventrally, no doubt as a result of the cameral deposits. Also in the anterior cross-section, the siphuncle wall appears to be thickened ventrally, this perhaps, as a result of the lining extending farther forward on the ventral side of the siphuncle. In the apical cross-section clear calcite fills the siphuncle and may represent the lining so thickened as to entirely fill the siphuncle.

Discussion: Flower (1962a) has previously described Buttsoceras williamsi from the Garden City Formation (Zone J or K) of Utah and Idaho. This is the first report of B. williamsi from the El Paso Group and not only extends its geographic range, but also restricts it to Zone J.

The two specimens described here add little to the original description (Flower, 1962), except to show some of the variation that occurs during ontogeny.

The specimen described first is not only the largest of the Florida Mountains Formation cephalopods, but also the largest and most complete Buttsoceras ever described. By adding at least another half length to account for the living chamber and the remaining septate part of the shell, this Buttsoceras would have been a veritable giant, possessing a conch at least 300 mm long.

Type and occurrence: Hypotypes, NMBM Nos. 1026 and 1627. Both from the southern Franklin Mountains, above the Scenic Drive, El Paso, Texas.

Buttsoceras sp.
Pl. 4, figs. 4-8

Here described as Buttsoceras sp. is a phragmocone 125 mm long with all but the apical 40 mm enclosed in matrix. A small portion of the shell exposed apically is smooth.

Cross sections were cut 4 mm, 55 mm and 200 mm from the apical end; a vertical section was cut between the later two. The cross sections (Pl. 4, figs. 4, 6, 7) all show extensive recrystallization and each shows the shell and siphuncle to have a different shaped cross section. The apical cross section is essentially circular, the one at mid-length is compressed, and the orad one is depressed. The effect of changing cross sections is, of course, not real, merely the result of compression during fossilization. Most probably the real cross section is circular with a large, subcentral siphuncle.

The vertical section (Pl. 4, fig. 5) shows a large, subcentral siphuncle apparently composed of fusiform segments and extensive recrystallization that has destroyed most of the septa. Those septa that do remain have only a moderate curvature. Septal necks are short and rings, thin and homogeneous.

In vertical section (Pl. 4, fig. 5), the siphuncle also shows a thin ventral band of white calcite with matrix filling the remainder of the siphuncle. This thin band is apparently the forward growing portion of the lining; in the apical cross section white calcite almost completely fills the siphuncle, leaving only a small, dorsal cavity.

Discussion: From its large size and large siphuncle containing a lining, there can be little doubt that this specimen is a Buttsoceras; but which of the various species is difficult to tell. It may well prove to be a new species, but additional material is necessary before any specific assignment can be made.

Figured Specimen: NMBM No. 1656. From the orange weathering silts above the Scenic Drive in the southern Franklin Mountains, El Paso, Texas.

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PLATES 1-9

WITH EXPLANATIONS

PLATE 1

Figures — Page

1-5 *Rhabdiferoceras* (?) *franklinense*, n. sp. — 5

1. Vertical thin section (6X) made from the apical half of Fig. 2, showing the ventral rod, thinning orad, unusually flat septa, and thin episeptal deposits thickening against the mural part of the septum, short necks, and thin, homogeneous rings.

2. Vertical, opaque section (3X). 3. Oral cross section (4X), incomplete dorsally, showing moderately large, circular siphuncle slightly removed from the venter.

4. Ventral, weathered view, whitened (2X). 5. Apical cross section (4X), showing depressed section and depressed siphuncle. Holotype, NMBM No. 1638, from the east side of the southern Franklin Mountains, Texas.

6-7 *Protocycloceras* spp. — 19

6. Naturally weathered, essentially horizontal section (2.5X) through *P. sp.* (2); NMBM No. 1641, from the east side of the Florida Mountains, New Mexico. 7. Natural, weathered longitudinal section (2.5X) through *P. sp* (1), NMBM No. 1640, from the east side of the southern Franklin Mountains, Texas.

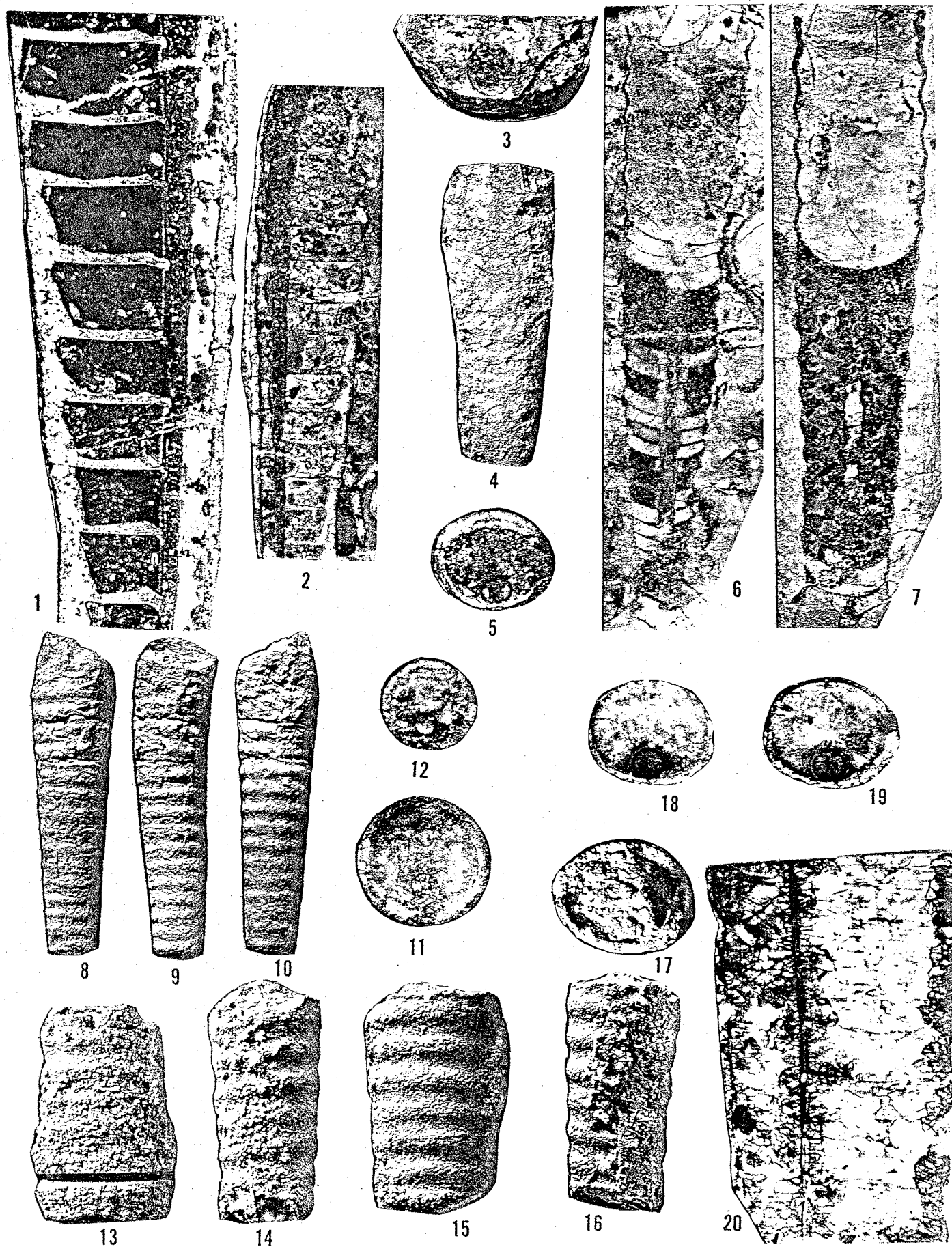
8-12 *Protocycloceras russelli*, n. sp. — 18

8. Ventral view, whitened (2X). 9. Lateral view, whitened, venter on left (2X), showing anterior, exogastric curvature.

10. Dorsal view, whitened (2X). 11. Septal view (4X), 17 mm from apical end, showing circular cross section and circular siphuncle, removed from the venter by less than one diameter. 12. Apical view (2X). Holotype, NMBM No. 1639, from the east side of the Florida Mountains, New Mexico.

13-20 Protocycloceras laswelli, n. sp. 13

13. Ventral view, whitened (2X), lighting reversed (specimen inverted), showing position of cross sections, fig. 18, 19. 14. Lateral view, venter on left, whitened (2X). 15. Dorsal view, whitened (2X). 16. Lateral view, venter on right, whitened (2X). 17. Anterior view, whitened (2X), showing depressed cross section. 18-19. Opposing cross sections (2X), 16 mm from apical end, showing siphuncle in contact with venter. 20. Vertical thin section through the apical 16 mm of the specimen (5X), showing thick, layered rings and extensive recrystallization. Holotype, NMBM No. 1642, from the east side of the southern Franklin Mountains, Texas.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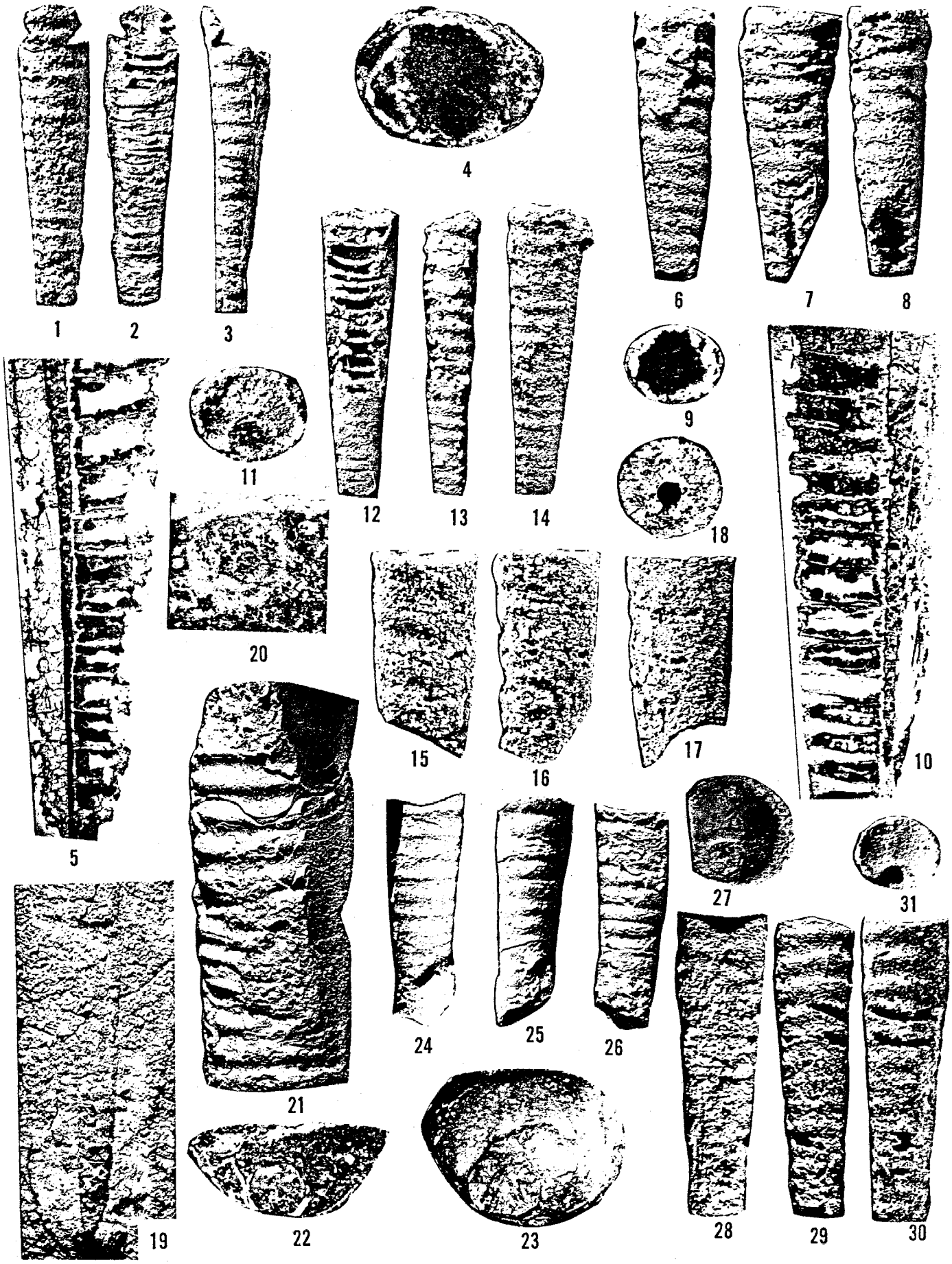
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PLATE 2

Figure | Page

1-14 Protocycloceras keadyi, n. sp. 10

Holotype, NMBM No. 1643: 1. Ventral view, whitened (1.5X). 2. Dorsal view, whitened (1.5X). 3. Lateral view, whitened, venter on left (1.5X). 4. Cross section, 26 mm from the apical end (4X), showing depressed section, siphuncle in contact with venter, and the crescent-shaped rod (retouched) half filling the siphuncle. 5. Anterior portion of the vertical thin section through the apical 26 mm of the specimen (4.5X) showing the rod, thin episeptal deposits, short necks, and thin, homogeneous rings.

Paratype, NMBM No. 1645: 6. Lateral view, whitened, venter on right (2X). 7. Ventral view, whitened (2X). 8. Lateral view, whitened, venter on left (2X). 9. Anterior cross section (2X). 10. Vertical thin section through entire specimen (4X) showing the same features as fig. 5.

Paratype, NMBM No. 1644: 11. Septal view, 4 mm from apical end of the specimen (4X). 12. Dorsal view, whitened (1.5X). 13. Lateral view, whitened, venter on right (1.5X). 14. Ventral view, whitened (1.5X).

All three specimens from the east side of the southern Franklin Mountains, Texas.

15-20 Protocycloceras elongatum, n. sp. 8

Paratype, NMBM No. 1655: 15. Ventral view, whitened (5X). 16. Lateral view, venter on left, whitened (5X). 17. Dorsal view, whitened (5X). 18. Anterior view (5X) showing small, subcentral siphuncle and circular cross section.

Holotype, NMBM No. 1654: 19. Weathered, dorso-lateral view (2X), showing conical protoconch. 20. Cross section, 39 mm from apical end (4X), showing small, subcentral siphuncle and circular cross section.

Both specimens from the east side of the southern Franklin Mountains, Texas.

21-23 Catoraphiceras sinuatum, n. sp. 26

21. Ventral view, whitened (2X) showing prominent ventral lobe. 22. Apical cross section (2X), incomplete dorsally, showing large, submarginal siphuncle, depressed in section, 23. Septal view, 39 mm from apical end (2X), showing depressed cross section with large, submarginal siphuncle, depressed in section. Holotype, NMBM No. 1657, from the east side of the Florida Mountains, New Mexico.

24-27 Catoraphiceras sp. 30

24. Ventral view, whitened (2X), showing shallow, angular ventral lobe. 25. Lateral view, venter on left, whitened (2X). 26. Dorsal view, whitened (2X). 27. Anterior view, whitened (2X), incomplete laterally, showing depressed

section and large siphuncle, depressed in section and removed from the venter by less than half its vertical diameter. Figured specimen, NMBM No. 1653, from the east side of the Florida Mountains, New Mexico.

28-31 Catoraphiceras staceyi, n. sp. 28

28. Ventral view, whitened (2X), showing the narrow, rounded, ventral lobe. 29. Lateral view, venter on left, whitened (2X). 30. Dorsal view, whitened (2X), showing broad, shallow dorsal lobe. 31. Anterior view, whitened (2X), showing depressed section and small, circular, submarginal siphuncle. Holotype, NMBM No. 1652, from the east side of the southern Franklin Mountains, Texas.

PLATE 3

Figure | Page

1-3 Catoraphiceras sinuatum, n. sp. 26

1. Vertical thin section (9X) through the mid portion of fig. 2, showing short necks and thin layered rings; sinuous shape of the siphuncle wall gives the species its name. 2. Vertical, opaque section (3X) from which thin section, fig. 1, was made. 3. Thin section (20X) made from the opposing section to fig. 2; section is off center and siphuncle wall appears almost straight, layering in rings is clearly seen: an inner, thin opaque layer and an outer thicker, granular layer. Holotype, NMBM No. 1657, from the east side of the Florida Mountains, Texas. (See also Plate 2, figs. 21-23.)

4-8 Kyminoceras kottlowskii, n. sp. 23

4. Ventro-lateral view, whitened (2X), partially enclosed by matrix. 5. Apical cross section (3X), surrounded by matrix, showing the small siphuncle removed from the venter by a length equal to its diameter. 6. Vertical thin section (5X) showing short necks and thin, homogeneous rings and lack of cameral or siphonal deposits. 7. Enlargement (18X) of fig. 6 showing adventitious opaque material lining the outside of the siphuncle wall; thickening of the ventral shell wall stems in part from the mural part of the septum, but most is adventitious. 8. Enlargement (13X)

of fig. 6. Holotype, NMBM No. 1649, from the east side of the Florida Mountains, New Mexico. (See also, Plate 4, figs. 1-3, 9-12.)

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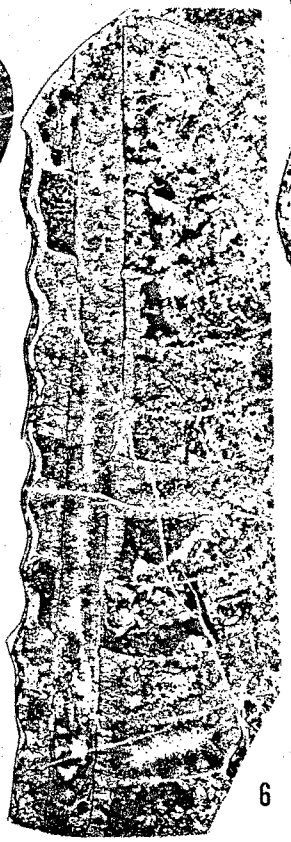

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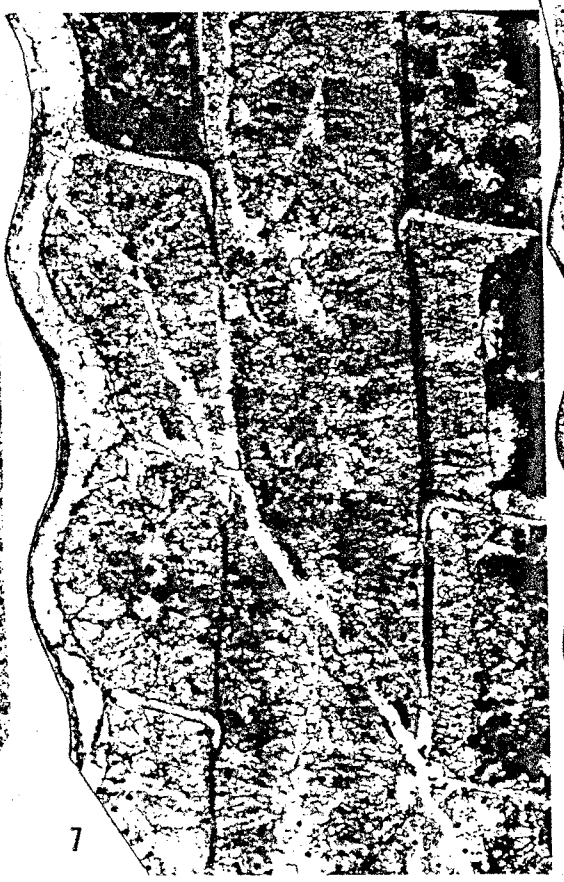

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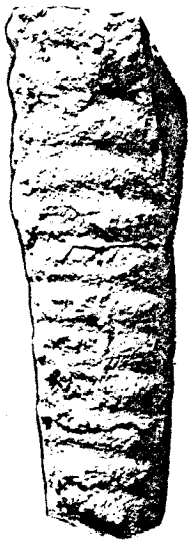

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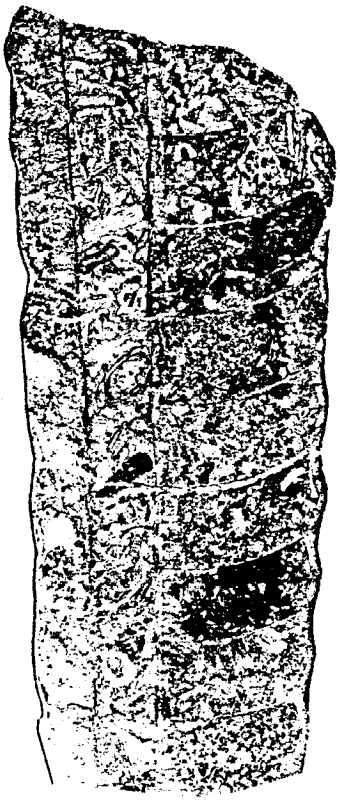

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PLATE 4

Figure — Page

1-3 Kyminoceras kottlowskii, n. sp. — 23

1. Ventral view, whitened (3X). 2. Vertical thin section (5.7X) showing short necks, thin, homogeneous rings, and lack of siphonal and cameral deposits. 3. Enlargement (17X) of fig. 2. Paratype, NMBM No. 1650, from the east side of the Florida Mountains, New Mexico. (See also Plate 3, fig. 4-8.)

4-8 Buttsoceras sp. — 52

4. Anterior cross section (2X) of fig. 5, oriented with venter down, showing a depressed section and a large, eccentric siphuncle. 5. Vertical, opaque section (2X) showing extensive recrystallization, fusiform siphuncle segments, a lining of clear calcite on the ventral side of the siphuncle, and an adventitious offset in the siphuncle about midlength. 6. Posterior cross section of fig. 5 (2X), oriented with venter down, showing a compressed section and a large, eccentric siphuncle. 7. Cross section, 4 mm from the apical end of the specimen, incomplete dorsally, showing a large, circular siphuncle. 8. Dorsally weathered, apical portion of the specimen (1.5X). Figured specimen, NMBM No. 1656, from the east side of the southern Franklin Mountains, Texas.

9-12 Kyminoceras kottlowskii (?) — 23

9. Apical cross section of fig. 10, (5X), showing depressed

section and small, circular siphuncle slightly removed from the venter. 10. Lateral view, whitened, venter on right (3X). 11. Anterior cross section (3X) incomplete ventrally, showing sepressed section and small, circular siphuncle. 12. Anterior portion of a thin section (10X) way off center, showing short necks, thin, homogeneous rings, and no cameral or siphonal deposits. From the east side of the Florida Mountains, New Mexico.

PLATE 5

Figure Page

1-14 Protocycloceras rhabdiferum, n. sp. 15

Holotype, NMBM No. 1646: 1. Anterior cross section (5X), incomplete dorsally, showing a moderately large, circular siphuncle slightly removed from the venter. 2. Weathered dorsal surface, whitened (1.5X). 3. Vertical thin section (2X) in which the rod and cameral deposits are well defined. 4. Enlargement (6X) of fig. 3, showing the rod, whose ventral margin is defined as a thin, dark line, completely filling the siphuncle apicad and thinning orad, short necks, thin homogeneous rings, and thin episeptal deposits.

Paratype, NMBM No. 1647: 5. Weathered dorsal surface (2X). 6. Cross section (3X) at anterior end of fig. 7, incomplete dorsally, showing the siphuncle slightly removed from the venter, two-thirds filled by the rod, which has a convex dorsal surface. 7. Vertical thin section through the apical 32 mm of fig. 5, extensive replacement has made the rod difficult to see, but its dorsal surface is delineated by a thin, white line.

Paratype, NMBM No. 1648: 8. Weathered, dorsal surface (1.5X). 9. Vertical opaque section (2X) through the apical 47 mm of the specimen. 10. Vertical thin section (2X)

made from fig. 9, showing cameral deposits preceding the rod in development. 11. Enlargement (6.8X) of fig 10. Anterior cross section, incomplete dorsally (4X), showing what was initially thought to represent two rods in the siphuncle. 13. Enlargement (11.5X) of the siphuncle. 14. Enlargement (10X) of the anterior end of fig. 9, showing the pods of inorganic calcite that were intersected by the plane of the cross section.

All three specimens are from the east side of the southern Franklin Mountains, Texas.

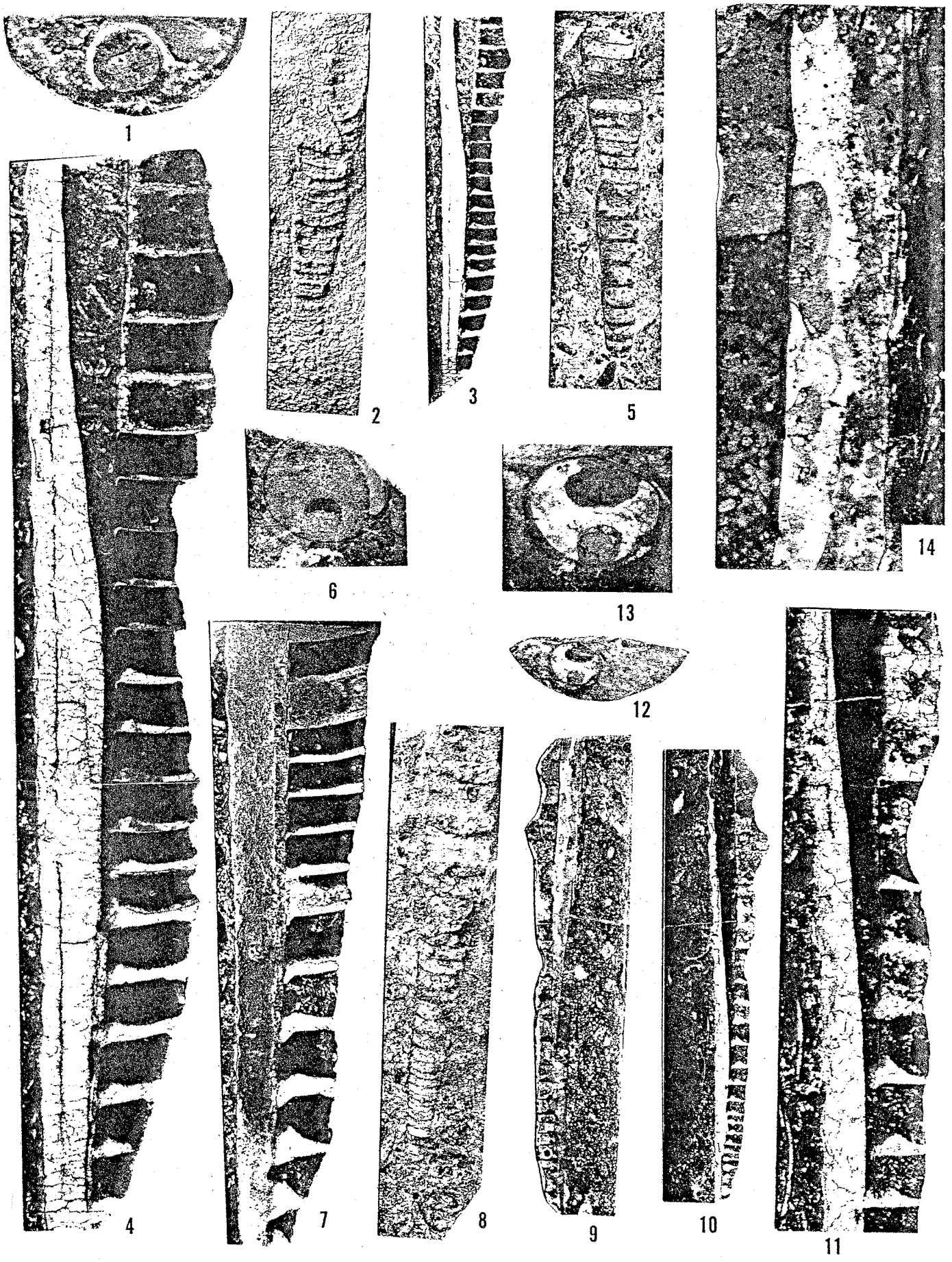
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PLATE 6

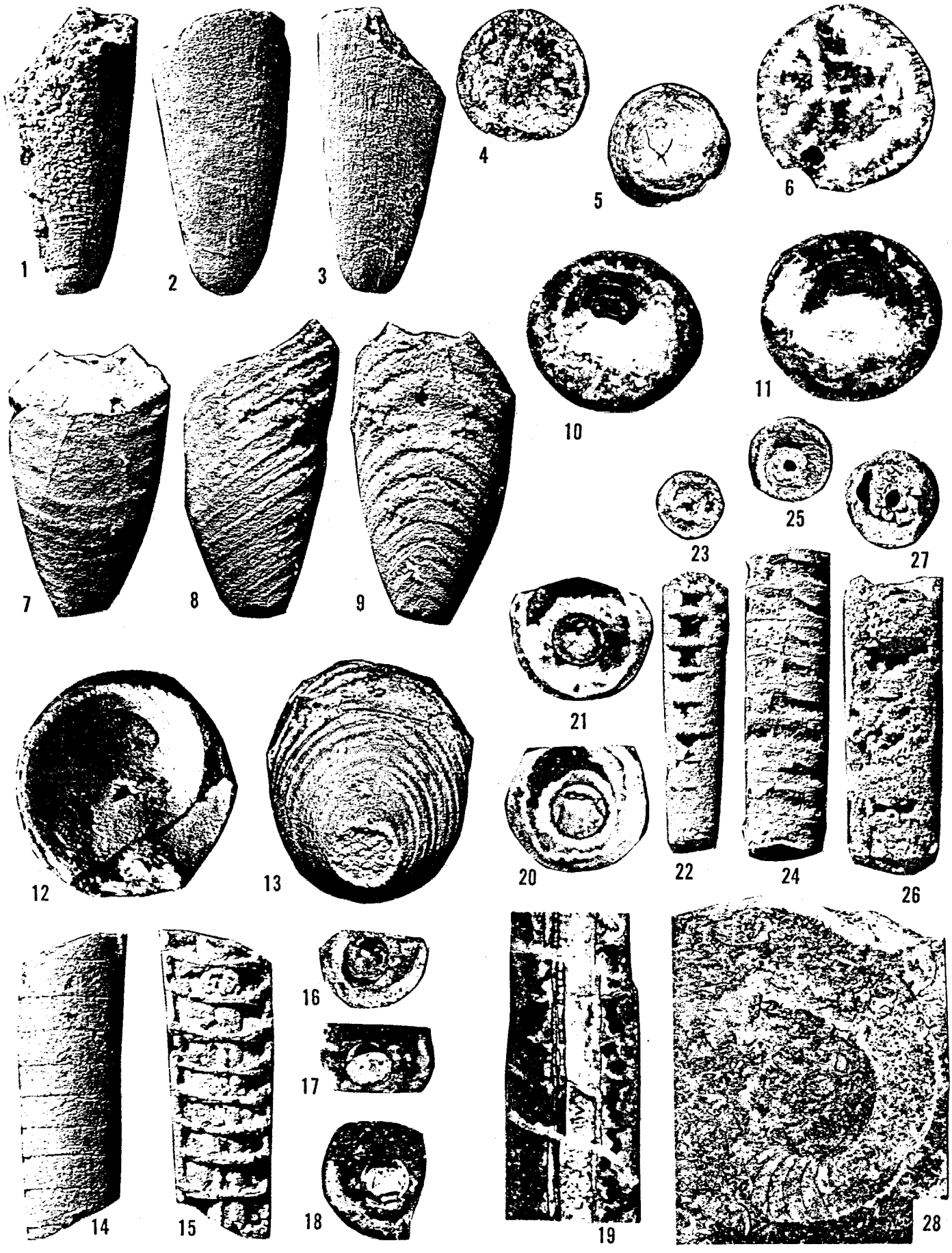


PLATE 6

Figure | Page

1-6 Clitendoceras (=Kirkoceras) sp. (?) — 31

1. Ventral view, whitened (2X). 2. Lateral view, venter on left, whitened (2X), showing faint endogastric curvature and, apically, two faint, oblique ridges (septal ridges ?) sloping apicad from the venter; note the very fine longitudinal markings in this and the dorsal view, fig. 3. 3. Dorsal view, whitened (2X). 4. Anterior view, venter down. 5. Apical view (2X), venter down, showing quadrate fracture-blade pattern. 6. Cross section (3X), 14 mm from the apical end of the specimen, venter down, showing compressed section, crescent-shaped tube dorsad of center, and two dorso-lateral blades. Figured specimen, NMBM No. 1625, from the east side of the southern Franklin Mountains, Texas.

7-13 Manchuroceras lemonei, n. sp. — 34

7. Dorsal view, whitened (1.5X). 8. Lateral view, venter on right, whitened (1.5X), showing septal ridges sloping apicad from the venter. 9. Ventral view, whitened (1.5X), showing the ridges splitting to form a narrow, midventral, flattened zone. 10-11. Opposing cross sections (2X), 13 mm from the apical end of the specimen, oriented with venter down, showing depressed section and concentric sheaths in

the dorsal one-third of the section. 13. Apical view, whitened (1.5X), showing the initial circular cross section and the septal ridges splitting on the venter. Holotype, NMBM No. 1625, from the east side of the southern Franklin Mountains, Texas.

14-16 Buttsoceras williamsi, Flower 49

14. Ventro-lateral view, whitened (1.5X), showing straight, transverse sutures. 15. Dorso-lateral view, whitened (1.5X), showing siphuncle closer to the right and thickening of septa by cameral deposits. 16. Anterior view, whitened (1.5X), incomplete dorso-laterally, showing large circular siphuncle. Figured specimen, NMBM No. 1627, from the east side of the southern Franklin Mountains, Texas. (See also Plate 9, fig. 1.)

17-21 Buttsoceras novemexicanum, Flower 45

17-18. Opposing apical cross sections (2X), venter down, showing large, circular, subcentral siphuncle with crescent-shaped dorsal cavity. In fig. 18, note the ventro-lateral, V-shaped structures in the siphuncle; these are probably adventitious since they are not evident in fig. 17. 19. Vertical opaque section (2X), venter on right, showing the dorsal cavity, increasing in height orad and anteriorly crossed by numerous diaphragms. 19-20. Opposing anterior cross sections (2X), venter down, showing the dorsal cavity subdivided by a

vertical partition. The linear structures in the siphuncle of fig. 19 are also thought to be adventitious since they are absent in fig. 20. Hypotype, NMBM No. 1632, from the east side of the Florida Mountains, New Mexico. (See also Plate 7.)

22-27 Buttsoceras adamsi (Butts) (?) 43

Three specimens attributed to Buttsoceras adamsi, all whitened (2X), showing wide variation in proportions; figs. 22-23, longitudinal and anterior views of one specimen, NMBM No. 1631; figs. 24-25, ventral and anterior views of NMBM No. 1634; and figs. 26-27, longitudinal and anterior views of NMBM No. 1630. All specimens from the east side of the southern Franklin Mountains, Texas.

28 Family Tarphyceratidae ? 36

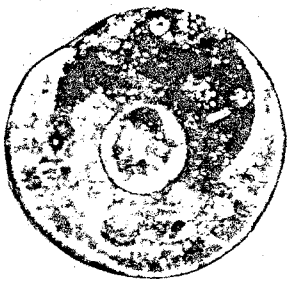
28. Weathered surface (1.5X), showing little more than half a volution, consisting of 6 camerae and the rest living chamber. Figured specimen, NMBM No. 1636, from the east side of the southern Franklin Mountains, Texas.

PLATE 7

Figure — Page

1-11 Buttsoceras novemexicanum Flower — 45

1. Cross section (5X), venter down, 22 mm from the apical end of the specimen, showing symmetrical distribution of cameral deposits with respect to the venter and the unusual, polygonal bodies lining the inside of the siphuncle. These bodies were at first thought to be similar to those of Bajkaloceras, but were later shown to be adventitious. 2. Thin section (8X) of fig. 1, 3. Figs. 4 and 7, longitudinal sections (5X) showing polygonal bodies in the siphuncle disappearing as grinding progressed. Figs. 3, 5, 6, and 8, the cross sections (4X) corresponding to the longitudinal sections, showing the position of the longitudinal planes. 9. Thin section (5.5X) made from fig. 7, venter on the right, showing well developed cameral deposits and within the siphuncle, the lining and the matrix-filled dorsal cavity. 10. Enlargement (13.5X) of anterior portion of the thin section, showing the short necks and thin, homogeneous rings of the siphuncle well. 11. Further enlargement (14X) of the thin section, farther apicad than fig. 10, showing the structures in greater detail. Holotype, NMBM No. 1633, from the east side of the Florida Mountains, New Mexico. (See also Plate 6, fig. 17-21.)



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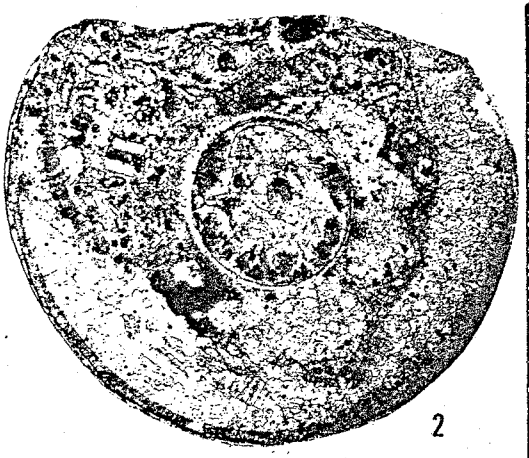

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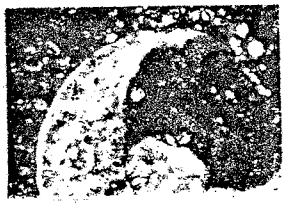

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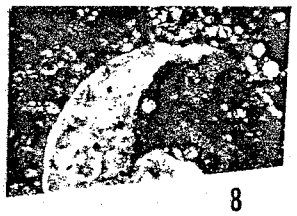

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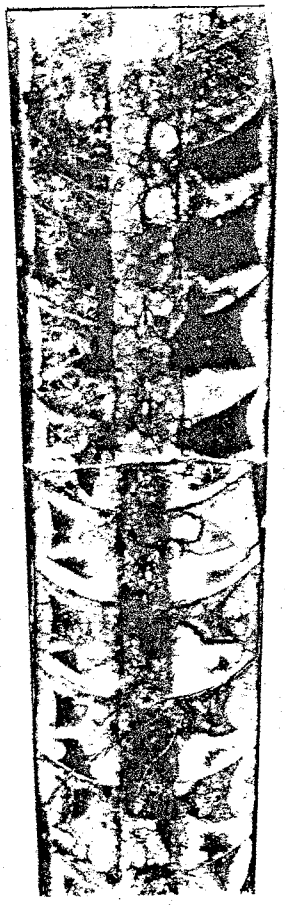

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PLATE 8

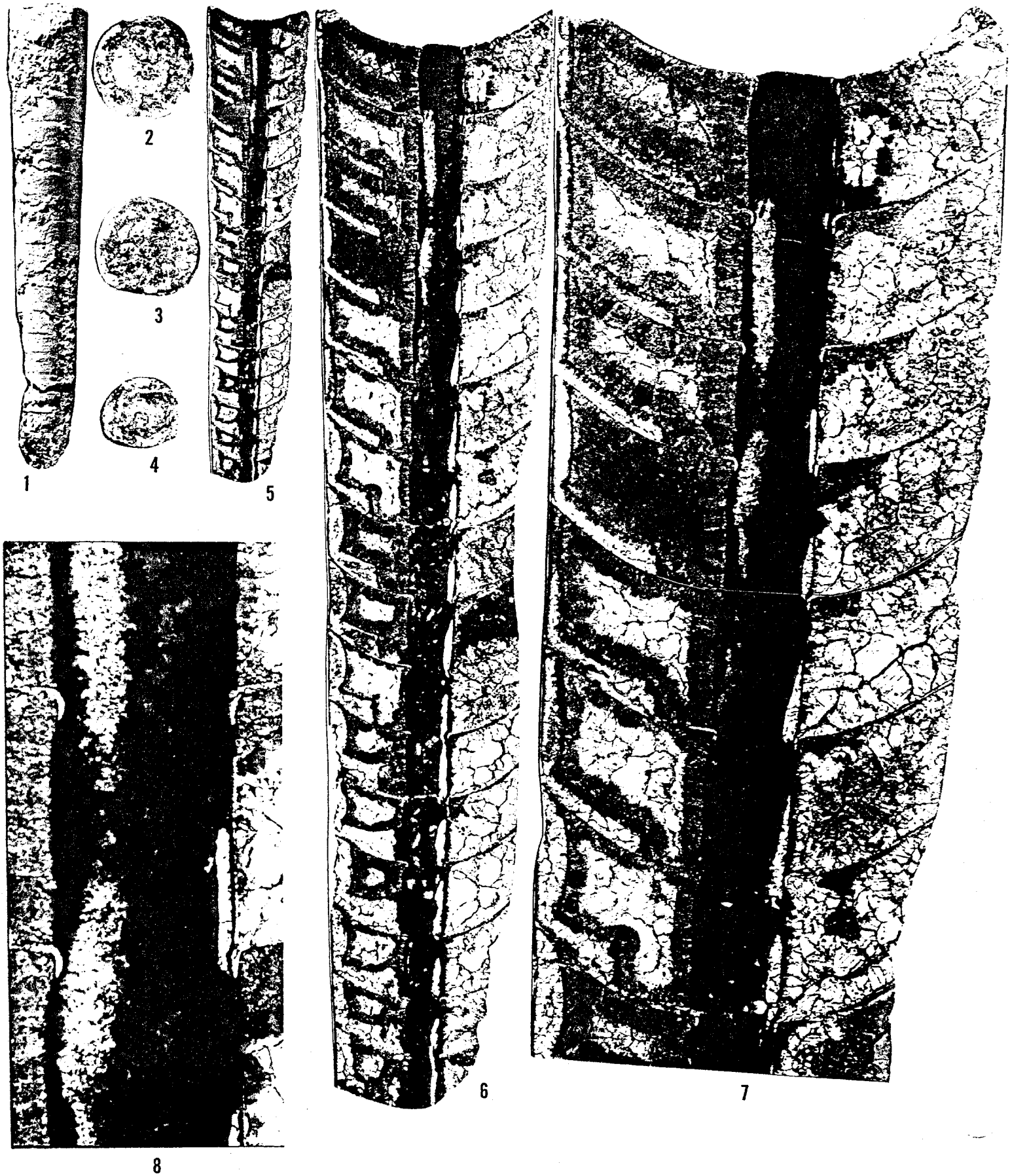

PLATE 8

Figure | Page

1-8 Michelinoceras floridaense, n. sp. 37

1. Ventral view, whitened (2X), showing nondescript shell and straight, transverse sutures. 2-3. Opposing cross sections (3X), taken 18 mm from the anterior end of the specimen, showing circular section and small, circular, subcentral siphuncle. 4. Septal view (3X), 9 mm from the apical end of the specimen. 5. Thin section (2.5X) of all but the apical 9 mm of the specimen, venter on right. 6. Enlargement (6.2X) of the thin section, showing cameral deposits completely filling the ventral portion of the camerae and thinner and L-shaped in the dorsal portion, and annuli lining the ventral siphuncle wall. 7. Further enlargement (10.5X) of the thin section, showing the short necks and thin, homogeneous rings along with showing the other structures in greater detail. 8. Enlargement of the siphuncle (27X), showing the anterior most annulus which has grown forward from the neck; white calcite on the left is adventitious. Holotype, NMBM No. 1636, from the east side of the Florida Mountains, New Mexico.

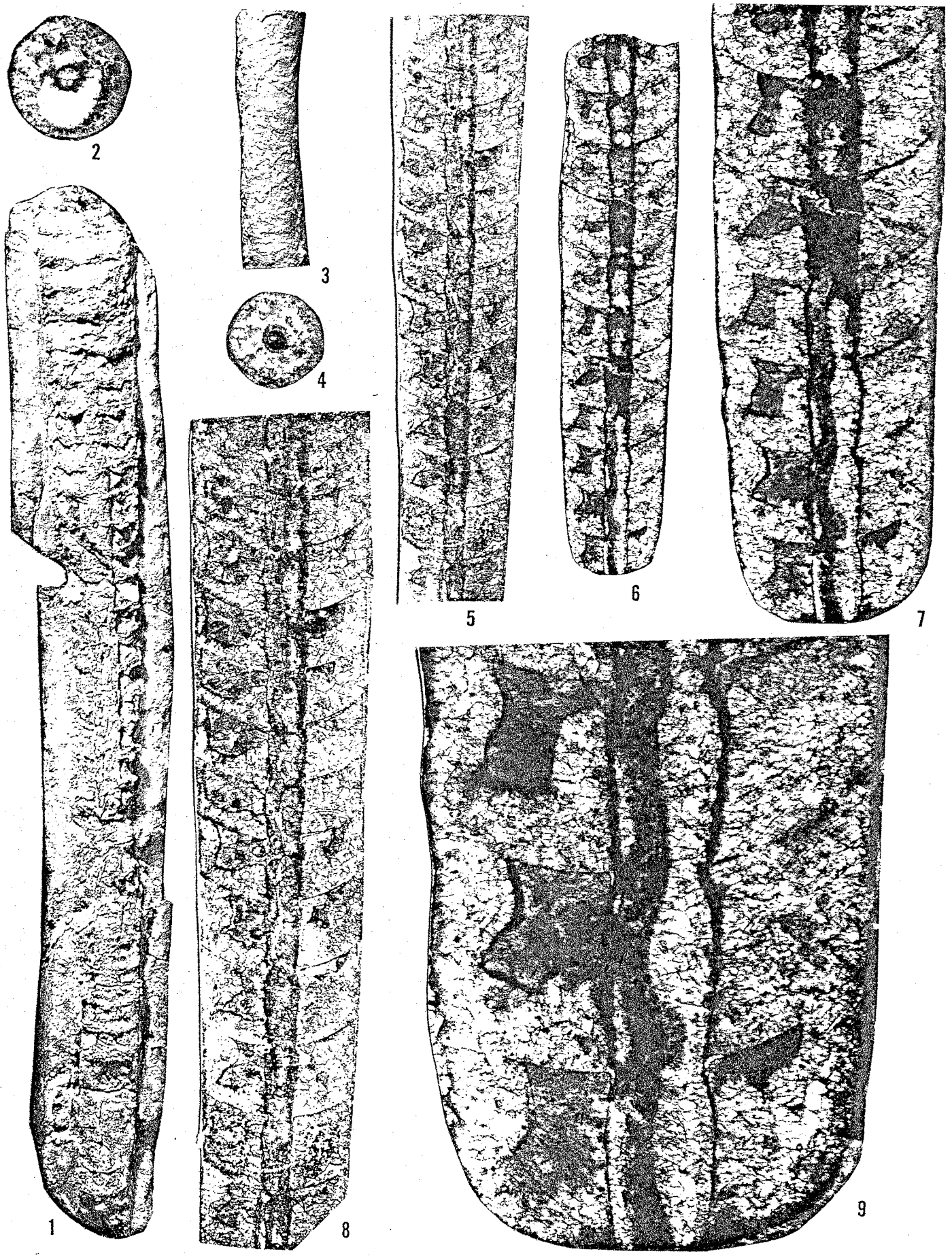
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PLATE 9

Figure | Page

1 Buttsoceras williamsi Flower — 49

1. Naturally weathered, horizontal (?) section through this, the largest of the Florida Mountains Formation cephalopods. About midlength the siphuncle has been breached, exposing the tube within the lining. Hypotype, NMBM No. 1626, from the east side of the southern Franklin Mountains, Texas. (See also Plate 6, fig. 14-16.)

2-9 Michelinoceras (?) melleni, n. sp. — 39

2. Anterior cross section (4X) of fig. 3, showing compressed section and small, circular siphuncle. 3. Ventral view, whitened (2X), showing smooth, slender orthocone; curvature is adventitious. 4. Apical cross section (4X) of fig. 3, showing a circular section. 5. Vertical thin section (4X) made from fig. 3, venter on right, showing fusiform siphuncle segments, cameral deposits, thinner and L-shaped on the left, and anteriorly, remnants of the dorsal tube. 6. Vertical thin section (6X) of the apical portion of the specimen, venter on right, showing the sinuous, dorsal tube in the siphuncle. 7. Enlargement (12X) of fig. 6, showing matrix within the tube and organic calcite surrounding it. 8. Enlargement (6X) of fig. 5. 9. Enlargement (28X) of the apical three camerae, showing the dorsal tube and clearly showing the short necks

and thin, homogeneous rings. Holotype, NMBM No. 1635, from the east side of the Florida Mountains, New Mexico.