PERMIAN FORAMINIFERA FROM BRITISH HONDURAS

by CHARLES A. ROSS

ABSTRACT. Fusulinids identified from the Macal Shale Group, Macal Series, south central British Honduras are *Schwagerina gruperaensis* Thompson and Miller, *Schwagerina* sp. A, *Eoverbeekina* aff. *E. americana* Thompson and Miller, *Ozawainella? sp.*, and *Staffella sp.* One species of the Trochamminid genus *Tetrataxis* also occurs in these strata. These species suggest correlation with the lower part of the Chochal Limestone of Guatemala, the Grupera Formation of Chiapas, Mexico, and the Lenox Hills Formation (upper part of the standard Wolfcampian Series, Permian), Glass Mountains, Texas.

FUSILINID bearing rocks from British Honduras in the collections of the British Museum (Natural History) are of considerable interest in adding to our knowledge of fusulinid distribution in central America and in helping to establish the age relations of late Carboniferous and early Permian strata in British Honduras.

I am indebted to Dr. Charles G. Adams, British Museum (Natural History), for loaning these interesting collections to me for study and for aid in locating, as closely as possible, their geographic position. Dr. June Phillips Ross read the manuscript and offered valuable suggestions.

Stratigraphy. The late Palaeozoic strata of British Honduras lie to the north-east of the east–west belt of late Pennsylvanian and early Permian shale and limestone that crop out discontinuously from Chiapas, Mexico, into eastern Guatemala. In Chiapas and Guatemala this late Palaeozoic sequence is dominantly composed in its upper part of limestone and dolomite which have been named the Grupera, La Vainilla, and Paseo Hondo Formations in Chiapas and the Chochal Limestone in Guatemala. In its lower part in this central American region the sequence is composed of the Santa Rosa Shale which gradually increases in thickness eastward along this belt of exposures (Kling 1960). Roberts and Irving (1957, pl. 1) and Kling (1960, p. 638) showed outcrops of the Santa Rosa Formation as far east as the Sarstoon River on the southern boundary of British Honduras.

In south central British Honduras the late Palaeozoic section is dominantly sandstone at its base and shale interbedded with a few beds of limestone in its upper part. These beds are called the Macal Series (Dixon 1956) in the central part of British Honduras where they reach 9,000 feet in thickness (text-fig. 1).

The following comments on the stratigraphy of the Macal Series are compiled from the excellent and detailed report by Dixon (1956, pp. 17–23). This series crops out principally in the structural basin that is drained by the Macal River (text-fig. 2). It unconformably overlies the metamorphosed Maya Series and is in turn overlain unconformably by various Cretaceous strata. A porphyritic intrusive in the southern part of the highlands appears to be younger than the Macal but older than the Cretaceous. The Macal Series is divisible into the Macal Sandstone Group below and the Macal Shale

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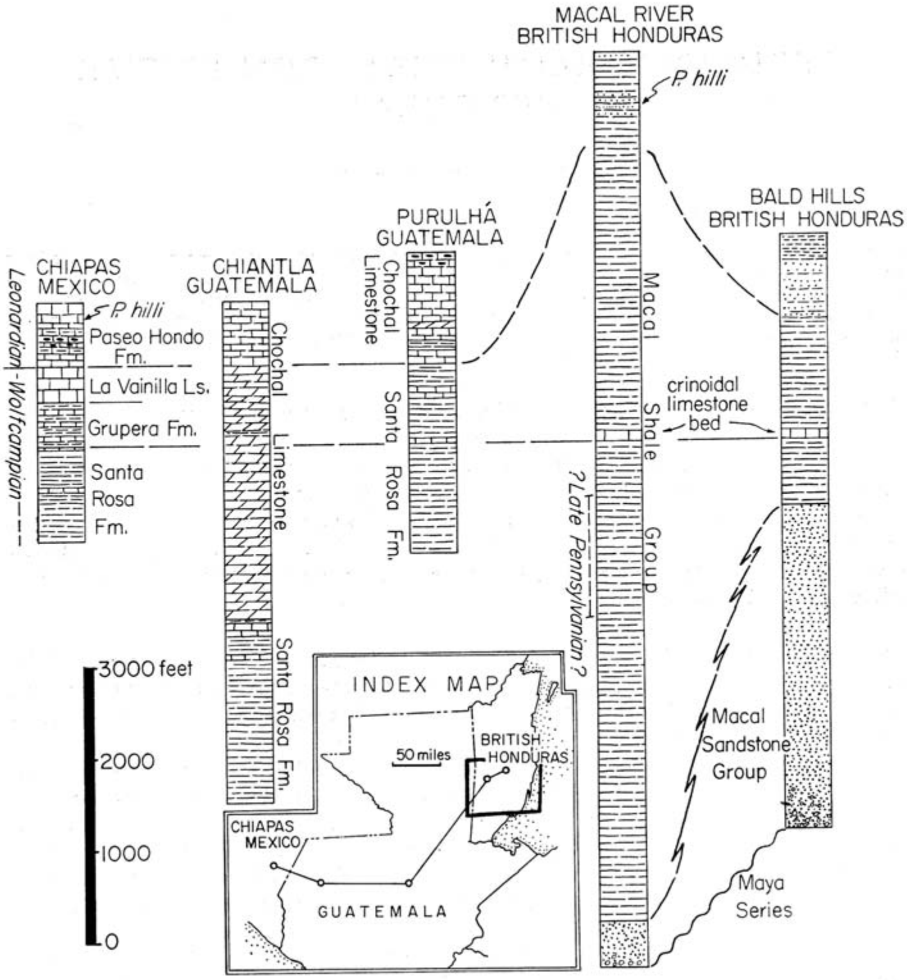


TEXT-FIG 1. Columnar sections and possible correlation of late Palaeozoic strata in Central America based in part on data from Thompson and Miller (1944), Dixon (1956), and Kling (1960). Outline indicates area of text-fig. 2.

Group above. The Sandstone Group has conglomerate at its base that includes cobbles and boulders of quartzite, phyllite, quartz, and, locally, granite which were apparently derived from the granitic masses that intruded and metamorphosed the Maya Series. The conglomerate changes upward into sandstone and the sandstone becomes interbedded with shale in its upper part. This Group passes gradationally into the overlying Macal Shale Group. As the Macal Sandstone Group is considerably thicker in the north-eastern part of the outcrop and the Macal Shale Group is correspondingly thinner, a facies relationship is suggested.

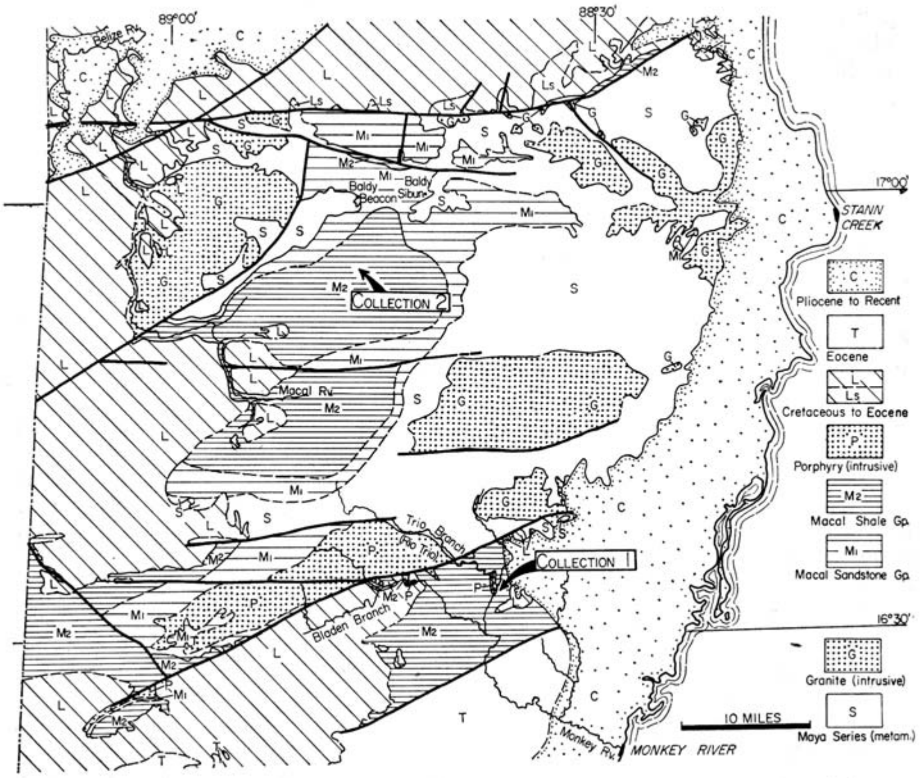
Within the Macal Shale Group a 50- to 100-foot sequence of crinoidal limestone forms a distinctive marker bed that lies near the middle of the group in the south (text-fig. 1). This is one of the few limestones in the group and one of the few which contains abundant fossils. Other thinner limestones occur higher in the sequence but are generally sparsely fossiliferous. From the lower part of the Macal Series Dixon (1956, p. 17) collected brachiopods that were identified by Muir-Wood as late Pennsylvanian in age, and from the upper part the ammonoid *Perrinites hilli* (Smith) which is a diagnostic Leonardian species.

The collections described in this report were made by L. H. Ower in 1922 and are from two localities (text-fig. 2), Rio Trio (Collection 1) and Bald Hills (Collection 2). Rio Trio or Trio Branch of the Monkey River flows across a faulted block of the Macal Shale Group 12 to 20 miles north-west of the coastal town of Monkey River. Wilson (1885) and Sapper (1899) collected from a thin crinoidal limestone along Rio Trio and reported fusulinids, and it is from this 8-mile belt that Ower apparently obtained Collection 1. 'Bald Hills' apparently refers to Baldy Beacon and Baldy Sibun about 6 miles south of the Northern Boundary fault and about 37 miles west of the coastal town of Stann Creek. Dixon (1956, p. 20) refers to a fossiliferous locality in the Macal Shale Group mentioned by Ower that was about 6 miles south of Baldy Beacon, and Collection 2 appears to be from this fossiliferous locality.

The specimens in both collections are poorly preserved. The fossils in the sample from Rio Trio (Collection 1) are partially replaced by secondary sparry calcite, marcasite, dolomite, and the rock is cut by numerous fractures filled with clear calcite and by styolites. The walls of specimens of *Staffella* are completely formed of clear secondary calcite (sparry calcite) and are surrounded by a dark, fine-grained matrix. Fusulinids are abundant in this collection. The fine-grained limestone sample from near Bald Hills (Collection 2) has only a few scattered, broken, and distorted specimens of fusulinids having a keriothecal wall such as that found in *Schwagerina* but these specimens are not identifiable to genus. This laminated limestone has crinoidal fragments and light and dark layers of calcilutite. The laminae are warped and irregularly folded suggesting distortion, perhaps as a result of nearby faulting.

Fusulinid assemblages. The abundant fusulinids from Collection 1 include *Schwagerina gruperaensis* Thompson and Miller, *Schwagerina* sp. A, *Eoverbeekina* aff. *E. americana* Thompson and Miller, *Ozawainella? sp.*, and a small form of *Staffella*. This assemblage is closely similar to that reported by Thompson and Miller (1944) from the Grupera Formation of southern Chiapas, Mexico. A tentative correlation of these late Palaeozoic strata of Central America is shown in text-fig. 2. *Schwagerina gruperaensis* is known from the Chochal Limestone of Guatemala (Kling 1960) and from the Grupera Formation of southern Chiapas, Mexico (Thompson and Miller 1944), where it occurs with or below such fusulinids as *S. chiapasensis* Thompson and Miller, *S. figueroai* Thompson and Miller, and *Paraschwagerina roveloi* Thompson and Miller. As Thompson and Miller (1944, p. 486) and Ross (1960, p. 122) noted, the species in this assemblage from Chiapas are advanced in their stages of evolution and are equivalent to the fusulinid assemblages in the younger part of the Wolfcampian Series.

Thus, although *Schwagerina gruperaensis* is closely similar in appearance to *S. guembeli* from the basal part of the standard Leonardian Series, its associated species in Chiapas and *Schwagerina* sp. A in British Honduras strongly suggest that this fusulinid zone of *S. gruperaensis* which extends across Central America includes rocks of late Wolfcampian (Lenox Hills) age (text-fig. 1).



TEXT-FIG. 2. Geologic sketch map of south central British Honduras showing location of the two collections studied. The map is generalized from the detailed geologic map by Dixon (1956). C, Pliocene to Recent, Cayo Series and coastal deposits; T, Eocene, Toledo Beds; L, LS, Cretaceous limestone, dolomite, and other sediments; P, porphyry intrusive rocks; M_2, M_1, upper Pennsylvanian to middle Permian Macal Series: G, granitic intrusive rocks; S, pre-upper Palaeozoic Maya Series (slates and metamorphosed sediments).

Many of the fusulinid species described by Thompson and Miller (1944) and Kling (1960) from younger beds in the late Palaeozoic rocks of Central America show many similarities to assemblages from the coarse-grained limestones of the Leonardian Series, Glass Mountains, west Texas (Ross and Oana 1961; Ross 1961; Ross 1962, text-fig. 2).

SYSTEMATIC DESCRIPTIONS

Genus SCHWAGERINA Möller, 1877

Schwagerina gruperaensis Thompson and Miller

Plate 46, figs. 1–9

1944 Thompson and Miller, p. 495, pl. 79, figs. 1–4.
1960 Kling, p. 638, pl. 78, figs. 7–10.

Description. Thickly fusiform tests that commonly reach 7·5 mm. in length and 2·2 mm. in diameter in six volutions. The proloculus ranges from 0·2 to 0·4 mm. outside diameter and the first volution is subglobose (Plate 46, fig. 8). Succeeding volutions become subcylindrical across the middle of the test, and the lateral slopes are abrupt, steep, and nearly straight and end in sharply pointed poles. These features give the test a crudely hexagonal outline in axial sections. The axis of coiling is straight.

Measurements of *Schwagerina gruperaensis* (Plate 46)

	Volutions	*Fig. 2*	*Fig. 5*	*Fig. 8*	*Fig. 4*	
Radius vector (mm.)	0	0·18	0·10	0·12	0·20	
	1	0·32	0·20	0·22	0·45	
	2	0·55	0·35	0·32	0·60	
	3	0·80	0·60	0·55	0·80	
	4	1·10	0·90	0·77	1·10	
	5	..	1·10	..	..	
Half length (mm.)	1	0·65	0·50	0·50	8	Number of septa
	2	1·05	0·85	0·80	20	
	3	1·55	1·50	1·50	26	
	4	1·85	1·95	1·60	28	
	5	..	2·60	2·50	27	
	6	..	3·70	..	..	
Form ratio	1	2·0	2·5	2·3	..	
	2	1·9	2·4	2·5	..	
	3	1·9	2·5	2·7	..	
	4	1·7	2·2	2·1	..	
	5	..	2·4	..	..	
Wall thickness (mm.)	0	0·02	0·01	0·02	0·01	
	1	0·01	0·01	0·02	0·01	
	2	0·02	0·01	0·04	0·01	
	3	0·05	0·01	0·03	0·02	
	4	0·08	0·04	0·06	0·03	
	5	..	0·05	..	..	
Tunnel angle (°)	1	20	30	25	..	
	2	20	25	25	..	
	3	30	30	35	..	
	4	..	20	35	..	
	5	..	25	..	..	

The wall is composed of a thin tectum and a keriotheca which becomes coarsely alveolar in the outer volutions (Plate 46, figs. 1, 7). The septa are closely spaced and folded into high, regularly spaced folds that reach two-thirds of the chamber height and commonly have flattened crests. These thin septa are a fine mesh of minute septal pores.

The narrow tunnel follows a regular path and its margins are difficult to delimit because of the lack of chomata. The tunnel height reaches about one-half that of the chambers. Secondary deposits coat the septal folds and tend to fill the folds near the axis and at the shoulder of the lateral slopes in the early volutions (Plate 46, figs. 2, 3, 5, 6, 8). In twelve tangential thin sections only one (extensively recrystallized) showed apparent cuniculi (Plate 46, fig. 9) and it is doubtful if this is an original feature of the test. The species is therefore retained in the genus *Schwagerina*.

Remarks. *Schwagerina gruperaensis* is closely similar in size, shape, and many internal structures to specimens of *S. guembeli* Dunbar and Skinner from the upper part of the zone of *S. crassitectoria* in the Hess Member, Leonard Formation, Glass Mountains, Texas (Ross 1960, p. 124). It differs from *S. guembeli* in having more closely spaced septal folds and heavier secondary deposits and in being slightly larger per corresponding volution. The specimens of *S. gruperaensis* illustrated by Kling (1960, pl. 78, figs. 7–10) from Guatemala have several additional volutions in comparison to specimens from British Honduras.

Occurrence. *Schwagerina gruperaensis* is common in samples from Collection 1, Rio Trio, British Honduras, and from the middle part of the Chochal Limestone of Guatemala (Kling 1960, p. 649). The type specimens are from the Grupera Formation in southern Chiapas, Mexico (Thompson and Miller 1944, p. 496).

Schwagerina sp. A

Plate 46, figs. 10–17

Discussion. Fusiform tests of six to six and a half volutions that commonly reach 4·8 mm. in length and 1·6 mm. in diameter. The proloculus is commonly small, 0·10 to 0·16 mm. outside diameter, and the first and succeeding volutions are low and elongate. The lateral slopes are gently rounded and meet in sharply pointed poles (Plate 46, figs. 10, 15, 16).

The wall is thin and is composed of a thin tectum and finely alveolar keriotheca. The septa are folded into low, regularly spaced folds that are about one-half chamber height; the upper part of the septa are nearly planar (Plate 46, figs. 10, 14, 17).

The tunnel follows a straight path in the midplane and the tunnel angle increases from about 25 degrees in the first volution to 40 degrees in the fifth. Chomata are lacking. Secondary deposits commonly thicken the septal folds along the axis and in the lateral regions of the chambers. These deposits tend to be discontinuous and not consistently located in all specimens.

Remarks. Specimens of *Schwagerina* sp. A are commonly fractured and are in part recrystallized so that the original structure of the wall and septa are usually poorly preserved. The keriotheca is commonly thin or missing or has been replaced by coarse sparry calcite or pyrite. The species' small size, low chambers, and fusiform shape separate it from most other described species of *Schwagerina*. In many of its features it resembles *Schwagerina tersa* Ross (1959) from the Lenox Hills Formation (upper part of the Wolfcampian Series), Glass Mountains, Texas, but *S. tersa* differs in having higher volutions and higher septal folds. *Schwagerina* cf. *S. emaciata* (Beede) described by Dunbar and Newell (1946, p. 469) from Bolivia is closely similar to *Schwagerina* sp. A in size and shape, but it has vestiges of pseudochomata and higher, more irregular, folded septa.

Occurrence. Collection 1, Rio Trio, British Honduras.

Measurements of *Schwagerina* sp. A (Plate 46)

	Volutions	*Fig. 10*	*Fig. 12*	*Fig. 15*
	0	0·05	. .	0·08
	1	0·12	. .	0·15
Radius	2	0·20	0·15	0·25
vector	3	0·40	0·20	0·40
(mm.)	4	0·70	0·35	0·65
	5	. .	0·55	. .
	6	. .	0·80	. .
	1	0·40	. .	0·40
Half	2	0·90	0·30	0·95
length	3	1·40	0·60	1·40
(mm.)	4	2·00	1·05	1·90
	5	. .	1·60	2·60?
	6	. .	2·40	. .
	1	3·3	. .	2·7
	2	4·5	2·0	3·8
Form	3	3·5	3·0	3·5
ratio	4	2·9	3·0	2·9
	5	. .	2·9	. .
	6	. .	3·0	. .
	0	0·05	. .	0·01
	1	0·01	. .	0·005
Wall	2	0·01	0·01	0·02
thickness	3	0·02	0·02	0·04
(mm.)	4	0·04	0·03	0·06
	5	. .	0·04	. .
	6	. .	0·06	. .
	1	25	. .	35?
Tunnel	2	30	30	40?
angle	3	30	35	40?
(°)	4	. .	35	. .
	5	. .	40	. .

Genus EOVERBEEKINA Lee 1933

Eoverbeekina aff. *E. americana* Thompson and Miller

Plate 46, fig. 19

1944 Aff. *E. americana* Thompson and Miller, pp. 492–3, pl. 80, figs. 3–6, pl. 83, figs. 3–7.
1960 Kling, p. 647, pl. 78, figs. 1–6.

Discussion. These subglobose tests have diameters of 1·7 mm. and lengths of 1·0 to 1·2 mm. in eight to nine volutions. The poles are progressively more strongly umbilicate in each succeeding volution. Their walls are thin and commonly recrystallized to clear calcite so that the structure of the spirotheca and septa is poorly shown. A tectum and a light, translucent inner layer having what appears to be very fine alveoli are present. A dark band at the base of the translucent layer may be a Becke line at the boundary between the recrystallized wall and the sparry calcite filling the test. These specimens are crushed and are smaller, but the heights of the chambers at corresponding volutions are similar to those of the type specimens described by Thompson and Miller (1944, p. 492) and the specimens described by Kling (1960, p. 647) from Guatemala.

Occurrence. Collection 1, Rio Trio, British Honduras.

Measurements of *Eoverbeekina* aff. *E. americana* (Plate 46, fig. 19)

Volutions	*Radius vector (mm.)*	*Half length (mm.)*	*Form ratio*	*Wall thickness (mm.)*	*Tunnel angle (°)*
0	0·02	..	..	0·005	..
1	0·10	0·05	0·5	0·01	20
2	0·18	0·06	0·3	0·01	20
3	0·30	0·15	0·5	0·01	..
4	0·60?	0·30	0·5?	0·02	..
5	0·70	0·40	0·6	0·02	..
6	0·80	0·50	0·6	0·02	..

Genus OZAWAINELLA Thompson 1935

Ozawainella? sp.

Plate 46, fig. 20

EXPLANATION OF PLATE 46

Figs. 1–9. *Schwagerina gruperaensis* Thompson and Miller, Macal Shale Group, Rio Trio, British Honduras. 1, Oblique sagittal section showing coarse alveoli, BMNH P44714, ×20. 2, Axial section, BMNH P44715, ×10. 3, 5, Slightly oblique axial sections, BMNH P44716 and P44717, ×10. 4, Sagittal section BMNH P39145, ×10. 6, Deep tangential section, BMNH P44718, ×10. 7, Shallow tangential section cutting the outer three volutions, BMNH P44719, ×10. 8, Axial section showing shape of early volutions and low tunnel, BMNH P44720, ×20. 9, Tangential section close to base of a volution showing apparent low, narrow cuniculi that may be the result of recrystallization of the septa; clear area to right of cuniculi has recrystallized sparry calcite, BMNH P44721, ×20.

Figs. 10–17. *Schwagerina* sp. A, Macal Shale Group, Rio Trio, British Honduras. All figures ×10. 10, Axial section, BMNH P39146. 11, Tangential section, BMNH P39147. 12, 15, Axial sections, BMNH P44722 and P44723. 13, Deep tangential section, BMNH P39144. 14, Shallow tangential section BMNH P39148. 16, Deep tangential section, BMNH P39149. 17, Shallow tangential section, BMNH P39146.

Fig. 18. *Tetrataxis sp.* Macal Shale Group, Rio Trio, British Honduras. Axial section, BMNH P44726, ×20.

Fig. 19. *Eoverbeekina* aff. *E. americana* Thompson and Miller, Macal Shale Group, Rio Trio, British Honduras. Axial section, BMNH P44724, ×20.

Fig. 20. *Ozawainella? sp.*, Macal Shale Group, Rio Trio, British Honduras. Axial section, BMNH P44725, ×50.

Discussion. Several specimens of small discoid Foraminifera occur in Collection 1 from Rio Trio. They reach 0·64 mm. in diameter and 0·24 mm. in length in three volutions. The wall is composed of a tectum and a translucent layer below having fine striae. The septa are planar and the chomata are small and inconspicuous. Of particular note is the high outward extension of the chomata over the midplane of the test and the abrupt flexing of the lateral slopes to form broadly rounded shoulders (Plate 46, fig. 20).

The specimens have much in common with *Ozawainella* but the high chamber across the midplane is reminiscent of small specimens of *Reichelina*. The lack of strong chomata and heavy outer tectorial deposits leads me to consider these specimens as probably belonging to *Ozawainella*.

Measurements of *Ozawainella? sp.* (Plate 46, fig. 20)

Volutions	*Radius vector (mm.)*	*Half length (mm.)*	*Form ratio*	*Wall thickness (mm.)*	*Tunnel angle (°)*
0	0·03	..	..	0·01	..
1	0·09	0·05	0·5	0·01	20
2	0·15	0·07	0·5	0·01	20
3	0·32	0·12	0·4	0·015	..

Genus TETRATAXIS Ehrenberg 1843

Tetrataxis sp.

Plate 46, fig. 18

Discussion. Test has trochoid, spiral arrangement of the chambers and reaches 0·4 mm. in breadth and 0·4 mm. in height in six whorls. *Tetrataxis sp.* differs from most other species of *Tetrataxis* in having a notably higher and steeper spiral. It shows similarities to *T. millsapensis* Cushman and Waters (1928) but it has a deeper umbilical indentation.

Occurrence. Collection 1, Rio Trio, British Honduras.

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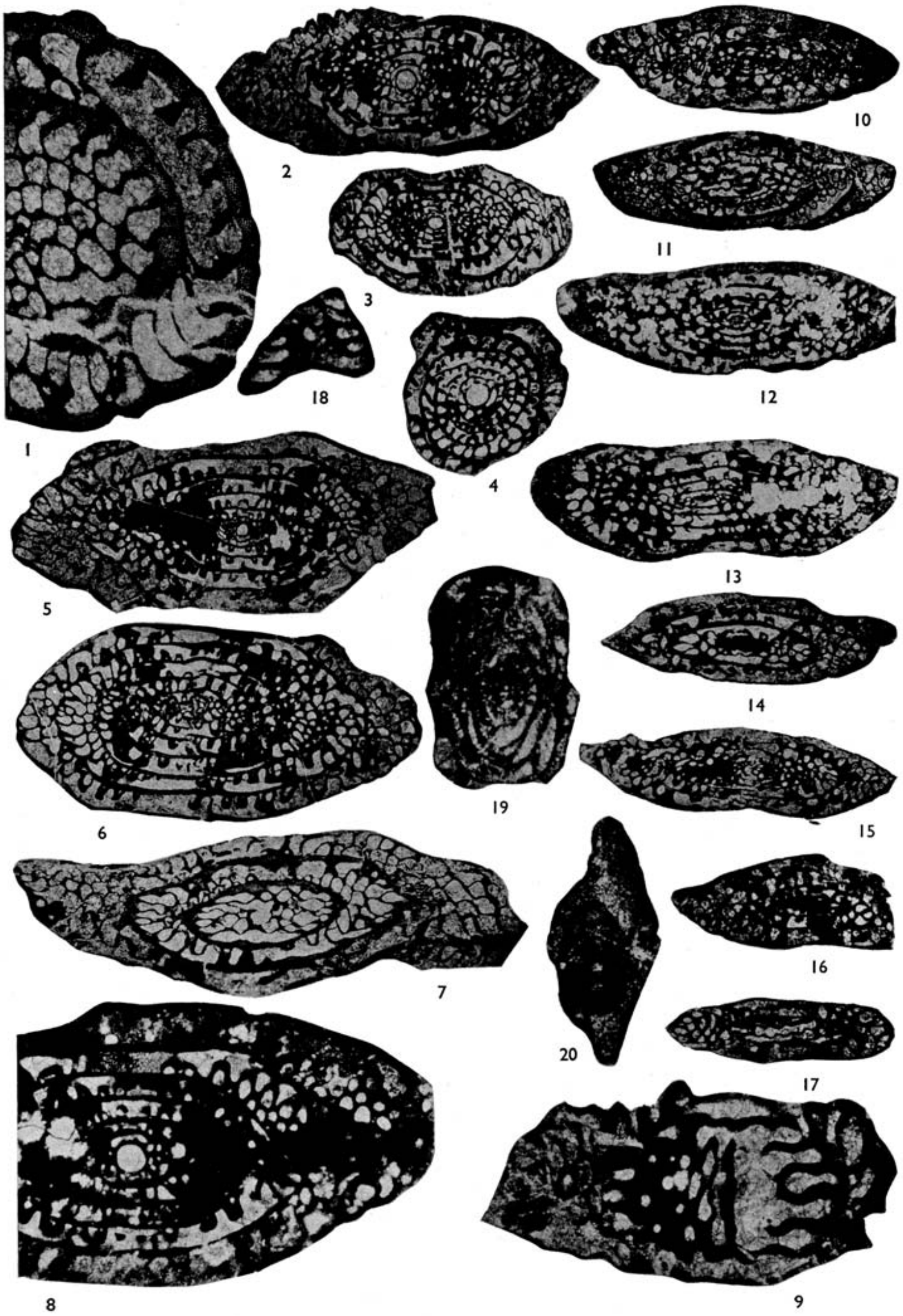

ROSS, Permian fusulinids