Fusulinid Biostratigraphy and Correlations Between the Appalachian and Eastern Interior Basins

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Prepared in cooperation with the Kentucky Geological Survey

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By RAYMOND C. DOUGLASS

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Fusulinids from western Kentucky and adjacent parts of Illinois and Indiana are compared and correlated with those from eastern Kentucky, Ohio, and western Pennsylvania

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FUSULINID BIOSTRATIGRAPHY AND CORRELATIONS BETWEEN THE APPALACHIAN AND EASTERN INTERIOR BASINS

By RAYMOND C. DOUGLASS

ABSTRACT

Fusulinids are common in marine rocks of the late Paleozoic succession in the Eastern Interior and Appalachian Basins. A detailed and systematic study of the fusulinids permits an improved correlation of the stratigraphy within and between these basins. Twenty-five species of fusulinids are recognized, of which 15 are forms previously named and 10 are new. Three additional forms are assigned only to genera. All the species are not represented in both basins, but they can be assigned to five zones and nine subzones that are recognized and correlated between the basins.

INTRODUCTION

In 1975, I was sent some limestone samples from southeastern Kentucky near the Virginia–Tennessee border, samples that contained many small fusulinids. I was asked whether these samples correlated with the Curlew Limestone Member of the Tradewater Formation of western Kentucky. Being unfamiliar with the Curlew, I asked whether comparative samples could be obtained from that unit. A suite of nine samples of the Curlew and mapped equivalents from five counties of western Kentucky was provided. On the basis of the contained fusulinids, these samples appeared to represent five different stratigraphic levels in three general groups – lower Atokan, upper Atokan, and Desmoinesian. The sample from the type locality of the Curlew in Union County, Ky., belonged about in the middle of this suite.

To get better control from the Middle Pennsylvanian part of the section, a set of core samples was studied from seven wells drilled at sites in six western Kentucky counties. It was gratifying to recognize in the core samples all the fossil horizons that had been studied in the surface samples. This study revealed that the Curlew Limestone Member was not represented in the samples submitted from one of the wells, but, because adjacent horizons were recognized, I was able to request samples from the probable intermediate interval and to find the missing Curlew fusulinids in them.

The corroboration of the surface-sample interpretation by the well data led to a flurry of activity to determine the relative position of many of the limestone beds in the surface exposures throughout western Kentucky. Additional well-core samples were investigated and correlated with the surface samples.

One of the obvious discrepancies noted early in the study was the difference between the type Curlew in Kentucky and the reported Curlew of southern Illinois. This difference pointed up the problem of correlation with the States adjacent to Kentucky, so samples from fusulinid-bearing units in Indiana and Illinois were collected and studied. These samples and the published record have made the correlation through the Illinois Basin possible.

Fusulinids from the Appalachian Basin had been described previously from Ohio, so samples were collected from various Middle and Upper Pennsylvanian horizons from which fusulinids had been reported. To round out the picture, samples were also collected from localities in western Pennsylvania, samples containing the easternmost fusulinids known in the United States.

ACKNOWLEDGMENTS

Most of the samples and stratigraphic data for this study were provided by C.L. Rice and T.M. Kehn of the U.S. Geological Survey (USGS), who both worked in cooperation with the Kentucky Geological Survey, Lexington, and by J.G. Beard of the Kentucky Geological Survey. Some core material was provided by the Institute of Mining and Mineral Research, University of Kentucky, Lexington. Additional faunas studied from collections in the U.S. National Museum of Natural History, Smithsonian Institution, Washington, D.C., were supplemented by collections that I made in Kentucky, Ohio, and Pennsylvania, with the aid of C.L. Rice and Richard Margerum, USGS; C.H. Cheong, Department of Geology, Seoul National University, Seoul, South Korea; and Rucha Ingavat, Geological Survey Division, Department of Mineral Resources, Bangkok, Thailand. Thin sections for the study were prepared with great skill and dexterity by Richard Margerum.

Types for comparison were kindly lent by the Peabody Museum of Natural History at Yale University, New Haven, Conn., the Illinois State Geological Survey at Urbana, and the State University of Iowa, Iowa City. Susanne Kaiser, USGS, assisted in compilation of data for this report, and Linda Jacobsen, USGS, assisted on the text figures. The typescript was read by C.L. Rice, T.M. Kehn, T.W. Henry, and D.A. Meyers, all USGS; their helpful comments are greatly appreciated.

PREVIOUS STUDIES

Several published studies are especially pertinent to this report. Dunbar and Henbest (1942) documented an extensive study of the fusulinids and stratigraphy of Illinois. Thompson (1936) described some of the fusulinids from Ohio; Thompson and Riggs (*in* Thompson, Shaver, and Riggs, 1959) studied early fusulinids from western Kentucky; and Thompson and Shaver (1964) evaluated early fusulinds from Illinois, Indiana, and Kentucky. Smyth (1957, 1974) documented fusulinids from Ohio and adjacent parts of Kentucky and Pennsylvania, and St. Jean (1957) studied some fusulinids from Indiana. Wanless (1975) presented a regional analyses of the Pennsylvanian System in the Appalachian region and the Illinois Basin region. Rice, Kehn, and Douglass (1979) published on Pennsylvanian correlations between the Eastern Interior and Appalachian Basins. Douglass (1979) illustrated the distribution of fusulinids and their correlation between the Illinois Basin and the Appalachian Basin.

CURRENT STUDY

This paper documents the fusulinid faunas and correlations between the Eastern Interior Basin and the Appalachian Basin, providing a biostratigraphic framework and a description of the fusulinids. The study started when a few samples were sent in for identification but grew rapidly as more samples were acquired. Surface samples were studied from all the exposed Pennsylvanian limestone units in western Kentucky. Figure 1 shows localities from which the samples were taken. Comparative material was also assembled from Illinois and Indiana (fig. 1). Supplemental samples were taken from many drill hole cores. The calcareous intervals represented in the cores were sampled for fusulinids. A large number of surface samples was also assembled from the Appalachian Basin, from Bell County in southeastern Kentucky along a broad line extending north-northeast through Ohio and east into western Pennsylvania. Two drill holes in eastern Kentucky were also sampled for the calcareous intervals containing fusulinids. Figure 1 also shows the localities in the Appalachian Basin. The localities and the included collections are described elsewhere in this report. Every effort was made to obtain as complete a representation of the fusulinid faunas from the two basins as possible. Rumors of possible fusulinids in the proposed Pennsylvanian stratotype section in central West Virginia were pursued in the field and in laboratory studies, but no fusulinids were found. Collections from the Kentucky and Ohio areas near the West Virginia border commonly yield good Pennsylvanian fusulinids.

Preparation of useful thin sections of the fusulinids was a difficult task, especially in samples of nearly black calcareous shale and argillaceous limestone. Fortunately, Richard Margerum was able to use his knowledge and skill to obtain oriented sections even under the most difficult conditions.

Throughout the study, T.M. Kehn and C.L. Rice provided consultation on field relations and physical correlation to supplement the published stratigraphic data and were able to collect samples to fill out the stratigraphic sections in Kentucky and in the adjoining States.

The present study is based on these collections and on many samples available in the National Museum of Natural History (USNM) and in the collections at Yale University (YPM), the State University of Iowa (SUI), and the Illinois State Geological Survey (ISGS).

GEOLOGIC SETTING

The two depositional areas of rocks of late Paleozoic age are separated by the structural high of the Cincinnati Arch. To the east is the Appalachian Basin, and to the west is the Eastern Interior or Illinois Basin. This study concerns those parts of the Appalachian Basin represented in western Pennsylvania, eastern Ohio, and eastern Kentucky and those parts of the Eastern Interior Basin represented in southern Illinois, southern Indiana, and western Kentucky (fig. 1.)

APPALACHIAN BASIN

Pennsylvanian marine deposits are common in an elongate basin extending from Pennsylvania to Tennessee, but fusulinid foraminifers are not represented throughout the entire basin. Fusulinids required open marine waters and are, therefore, found only in the parts of the basin where the seas encroached on the estuarine and riverine deposits sufficiently to dominate the environment. Many parts of the basin have deposits containing mollusks and even brachiopods that could tolerate a more brackish-water environment. The oldest horizon containing fusiform fusulinids is in the Stoney Fork Member of the Breathitt Formation (formerly the Lost Creek Limestone of the Breathitt Formation of Morse, 1931), recognized in surface samples and drill cores in southeastern Kentucky (localities 45–53). Fusulinids of the same approximate age are found in the Boggs Limestone Member of the Pottsville Formation in eastern Ohio (localities 67, 74, 81). (Also, see fig. 2.) These two parts of the basin are separated by more than 100 miles in which correlative beds have not been identified. The younger section in Ohio contains additional fusulinid-bearing marine horizons represented by the upper and lower Mercer Limestone Members (as used by Smyth, 1957) of the Pottsville Formation.

The section in eastern Kentucky lacks fusulinid-bearing beds through most of the rest of the rocks of Middle Pennsylvanian age. Small indeterminate fusulinids were found at locality 55 in Carter County in rocks assigned to the Vanport Limestone Member of the Allegheny Formation. Abundant fusulinids occur on the Ohio border at locality 61 in Greenup County, Ky. The limestone at this locality was assigned to the Vanport Limestone by Phalen (1912) but is now considered equivalent to the Columbiana Limestone Member of the Allegheny Formation in Ohio. Fusulinid-bearing limestones are present at several levels through the Allegheny Formation in Ohio. The most persistent marine horizons are the Putnam Hill Limestone, the Vanport Limestone, and the Columbiana Limestone, all members of the Allegheny Formation. The principal area of outcrop for these units is in east-central Ohio, but the outcrops extend in a limited way into western Pennsylvania (localities 86, 87).

Marine zones of Late Pennsylvanian age are geographically more limited in the basin. The section in eastern Kentucky includes fusulinid-bearing beds of the Brush Creek and Cambridge Limestone Members of the Conemaugh Formation. These strata were found in outcrops and drill cores only in Boyd, Carter, and Lawrence Counties in northeastern Kentucky (localities 54–61). No occurrences have been confirmed from the adjoining areas of West Virginia. The Ohio part of the basin contains additional fusulinid horizons in the Conemaugh Formation in the areas of outcrop from Gallia County to Guernsey County. The principal units, as in Kentucky, are the Brush Creek and Cambridge Limestone Members that represent the Missourian Series. The Ames and Gaysport Limestone Members of the Conemaugh Formation also yield fusulinids at some localities in the same area. These horizons represent Virgilian age. One locality (88) in Pennsylvania at Brilliant Cut contains fusulinids that suggest Virgilian age. No fusulinids younger than the Conemaugh are known from the Appalachian Basin.

EASTERN INTERIOR (ILLINOIS) BASIN

The western part of Kentucky includes the southeastern part of the late Palezoic Eastern Interior Basin that covered much of Illinois and extended into adjoining States. The section in western Kentucky includes beds ranging in age from Early Pennsylvanian through the Late Pennsylvanian and locally contains a remnant of the Early Permian section (fig. 3).

Fusulinid-bearing marine beds, which are irregularly interspersed with sandstone, shale, and coal beds, are more persistent laterally than they are in the Appalachian Basin. A relatively complete fusulinid succession through the Middle and Upper Pennsylvanian is available from surface exposures and drill-core samples. The oldest fusulinid horizon is a little older than any represented in the Appalachian Basin and is found in the Lead Creek Limestone Member of the Tradewater Formation. This horizon is present in surface samples in southern Indiana and in surface and drill-core samples in seven counties in western Kentucky. It has not been recognized in Illinois (fig. 4). The youngest fusulinid horizon is of Early Permian age and is known only from an unnamed limestone in the Mauzy Formation in a graben of the Rough Creek Fault system (locality 19) in Union County, Ky. Rocks containing fusulinids of latest Pennsylvanian age are found at locality 1 in Cumberland County, Ill.

FAUNAL SUCCESSION

Fusulinid zonations based on genera are commonly used to recognize divisions of the Pennsylvanian and Permian succession (Douglass, 1977). The rocks of the Eastern Interior Basin and the Appalachian Basin can be assigned to the fusulinid zones as commonly used, but, because of the large amount of data assembled for this study, it is appropriate to restudy the use of the zones as they apply specifically to these basins. The following discussion indicates the uses and the limitations of fusulinid zonation for correlation within and between the basins.

ZONE OF *MILLERELLA*

The zone of *Millerella* is commonly recognized as including beds of Early Pennsylvanian age below the first occurrence of *Profusulinella*. The genus *Millerella* is not well defined and ranges in age from at least Early Pennsylvanian to possible Permian. The upper limit of the zone is indefinite in the absence of *Profusulinella*. *Millerella* is present in rocks starting below the first *Profusulinella* and continuing into younger beds in several parts of the basins studied, but no attempt was

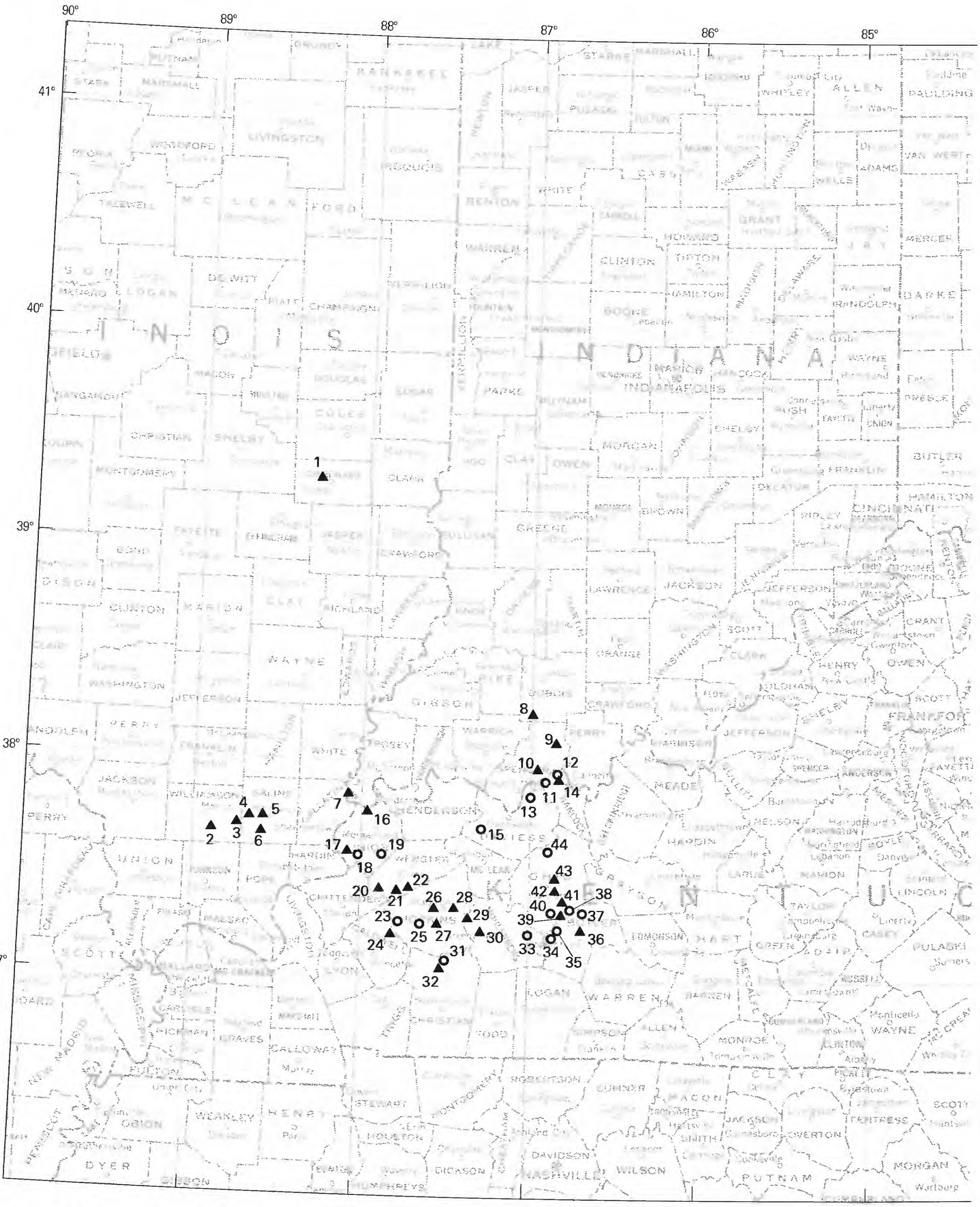


Figure 1.–Localities of fusulinid collections. The localities marked with triangles are surface samples; those depicted with circles are drill cores.

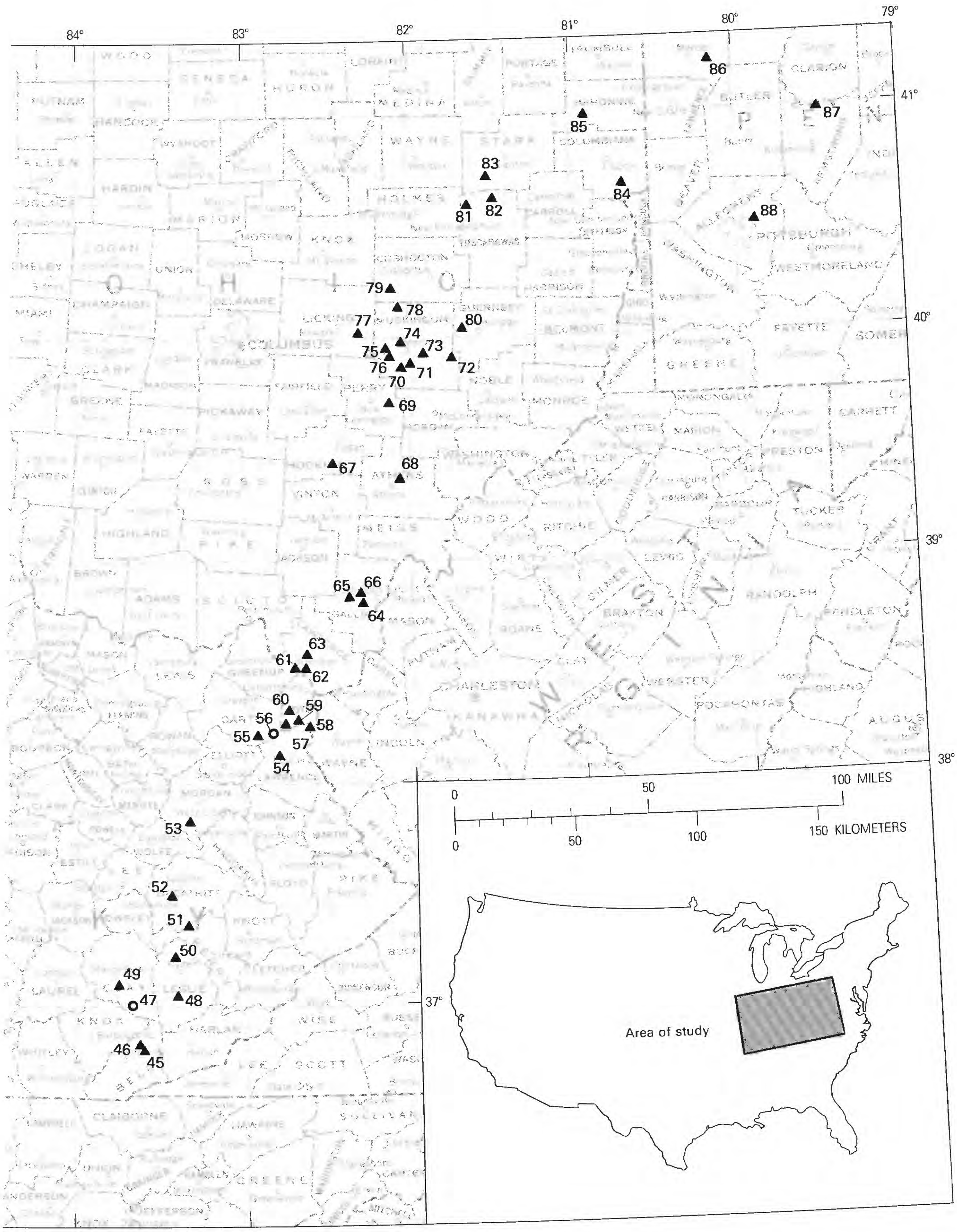


Figure 1.–Continued.

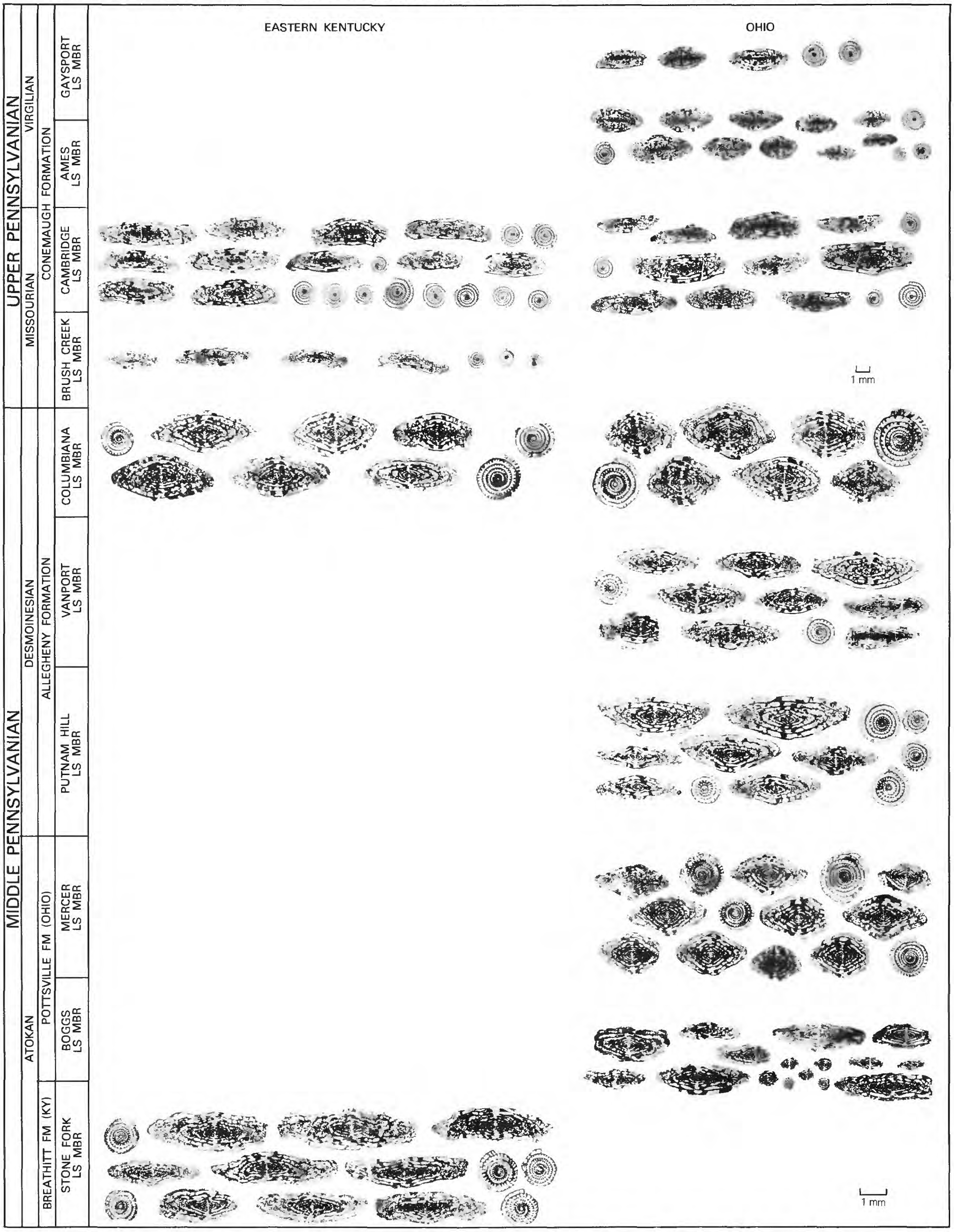


Figure 2. – Representative fusulinids of eastern Kentucky and Ohio. The correlation of the stratigraphic units shown and their relationship to the fusulinid zones are shown on figure 5.

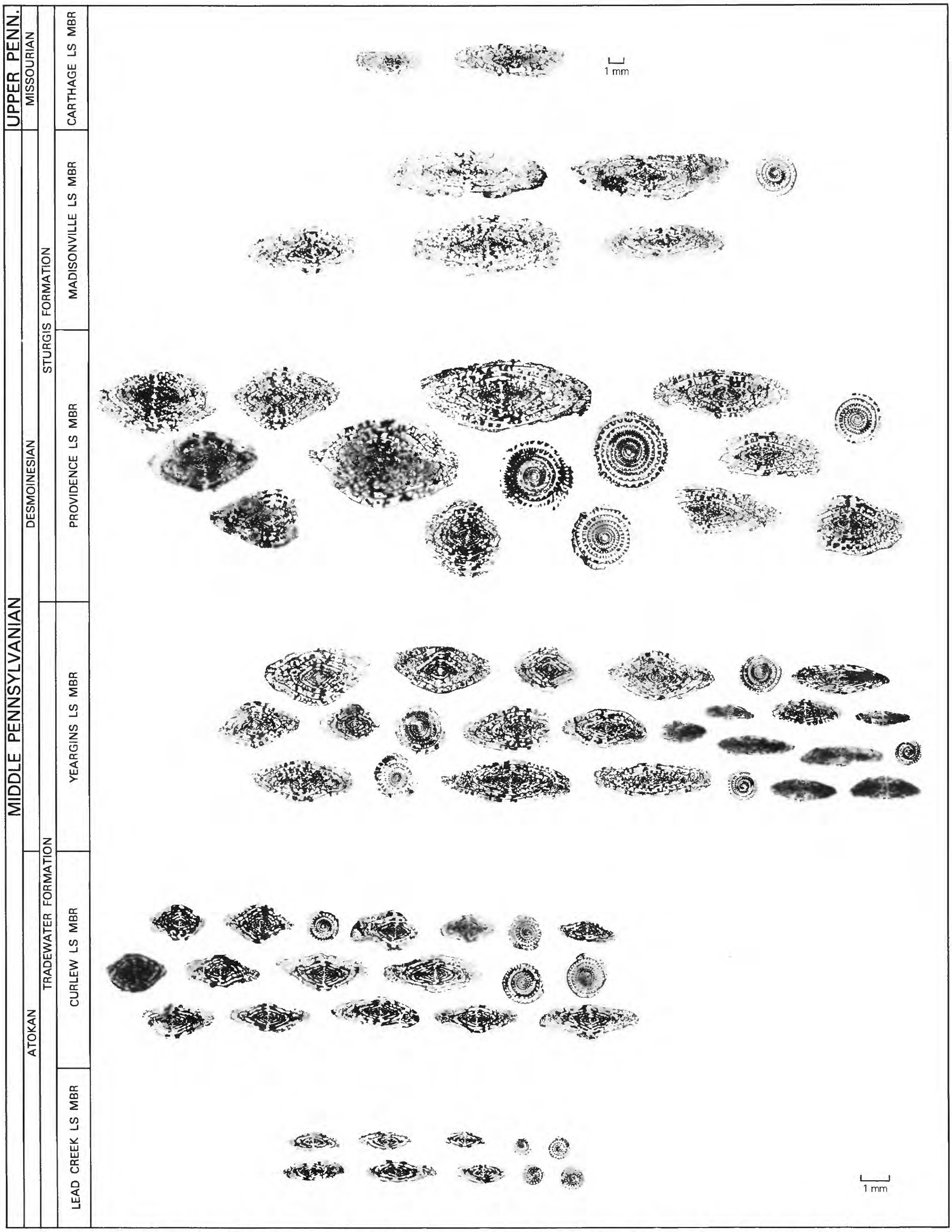


Figure 3.–Representative fusulinids of western Kentucky. The correlation of the stratigraphic units shown and their relationship to the fusulinid zones are shown on figure 5.

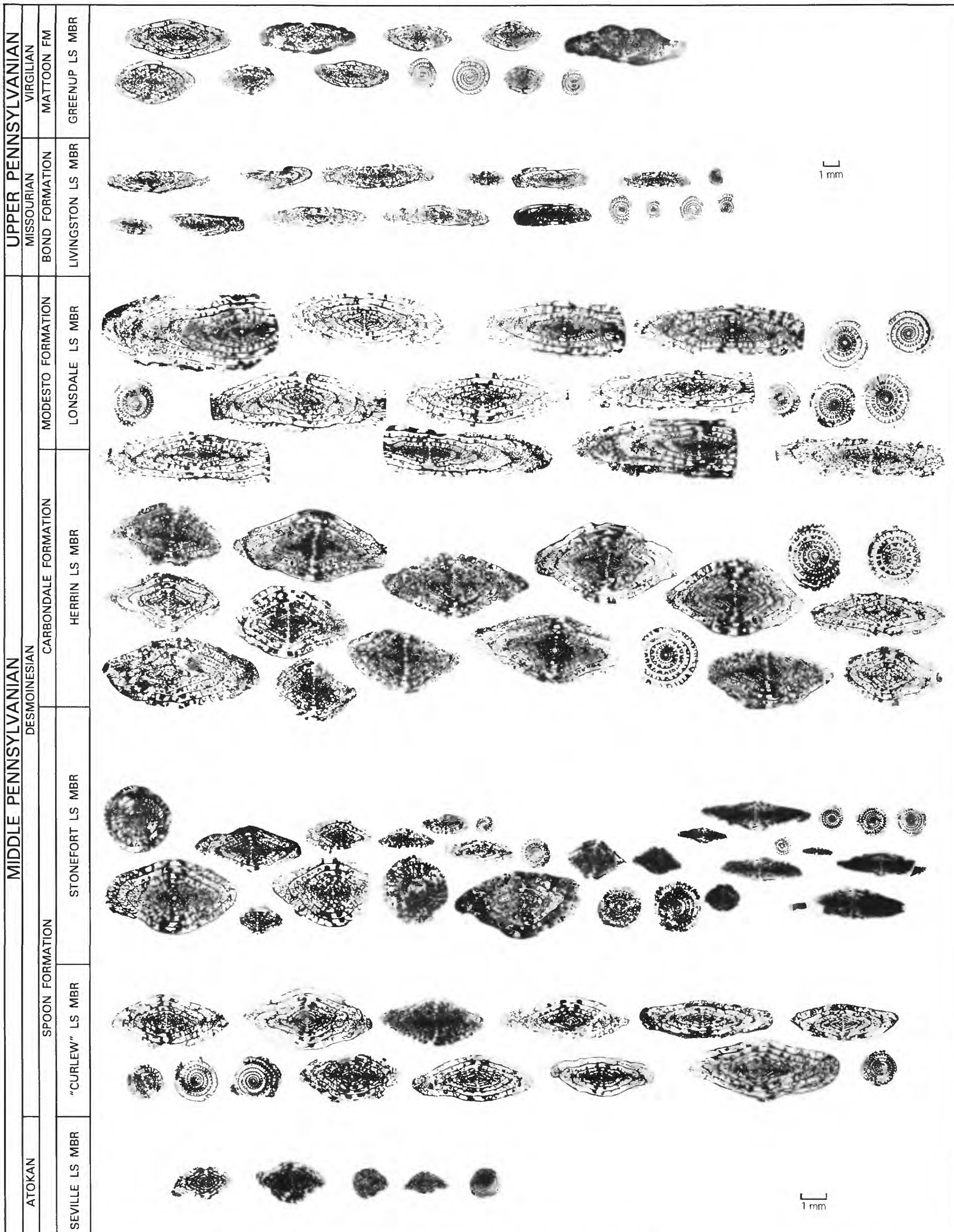


Figure 4.–Representative fusulinids of Illinois. The correlation of the stratigraphic units shown and their relationship to the fusulinid zones are shown on figure 5.

made to define the extent or limits of the zone for this study.

ZONE OF *PROFUSULINELLA*

The lower part of the Atokan series of Middle Pennsylvanian age is included in the zone of *Profusulinella*. The zone includes the beds between the first occurrence of *Profusulinella* and the first occurrence of *Fusulinella* (Douglass, 1977, p. 478). Restudy of the type Atokan (Sutherland, 1982) and of its fusulinids (Douglass 1982; Douglass and Nestell, 1984) indicates that the Kentucky and Oklahoma sequences have many similarities. Both sequences have an indefinite lower boundary because early forms of *Profusulinella* are unknown in the section, and both have beds containing more advanced profusulinellas that are followed by younger beds containing fusulinids assigned to *Fusulinella*. A clear-cut distinction between *Profusulinella* and *Fusulinella* would make a separation of the zones easy, but this is a gradational evolutionary sequence (Douglass, 1981). *Profusulinella* grades into *Fusulinella* by the addition of an inner tectorium in the outer volutions of a form, the juvenile form of which is profusulinellid.

In western Kentucky, *Profusulinella* is present in surface and drill-core samples. The surface exposures are from the Lead Creek Limestone Member (Lead Creek Limestone of Crider, 1913) of the Tradewater Formation and are found through about 15 ft of section, primarily in two limestone beds a little more than 6 ft apart. The section available in drill cores shows a similar set of beds at the top and an occurrence of *Profusulinella* 30–45 ft deeper. This lower set of beds has not been recognized in outcrop.

Profusulinella kentuckyensis Thompson and Riggs, 1959, characterizes the zone in western Kentucky. This species was described from the surface samples in Butler County (locality 36). The forms present in the drill cores show great variability (pl. 1) but are within the range of variation seen in the surface samples and have not been given a different name. None of the specimens from Kentucky resemble the early *Profusulinellas* described from Texas, New Mexico, and other Western States, and I assume that some of the forms from those areas represent an earlier stage of evolution. The species from Kentucky is a late form that has a tendency toward elongation and the incipient development of an inner tectorium. Surface samples have not yielded the next immediate stage in the evolutionary sequence, but the core hole at locality 21 in Webster County contains a fauna intermediate between *P. kentuckyensis* and *Fusulinella iowensis*, consisting of a primitive *Fusulinella* described as *F. primotina* n. sp.

The overlying horizon containing *Fusulinella iowensis* is 2.1–2.5 ft above *F. primotina*, and the underlying *Profusulinella kentuckyensis* is about 30 ft. below *F. primotina*. For practical purposes, the top of the *Profusulinella* zone and the base of the *Fusulinella* zone should be taken as the base of the Curlew Limestone Member of the Tradewater Formation. The base of the Curlew is not a sharp boundary because the limestone grades down into nodular limestone and calcareous shale that could be considered part of the Curlew.

Shaver and Smith (1974) summarized the studies of Thompson and Riggs (*in* Thompson, Shaver, and Riggs, 1959) and Thompson and Shaver (1964) for fusulinids of the Middle Pennsylvanian in Indiana and adjacent parts of Kentucky. Shaver and Smith reported *P. kentuckyensis* from the Fulda and Ferdinand Beds of the Lead Creek Limestone Member of the Mansfield Formation and *P. burrensis* from the Brazil Formation that they consider possibly younger than the Lead Creek Limestone. The first more advanced fusulinid that they reported is a *Fusulinella* sp. also from the Brazil Formation at a different locality. They proposed that the range of *Profusulinella* and *Fusulinella* may overlap in Indiana (Shaver and Smith, 1974, p. 17). *F. iowensis* occurs in the overlying Staunton Formation. Verification of the undescribed form of *Fusulinella* would suggest the *Profusulinella* persisted longer in Indiana than it seems to have persisted in Kentucky.

The zone of *Profusulinella* has not been identified in the Appalachian Basin. The oldest fusulinids present are in the Stoney Fork Member of the Breathitt Formation and the Boggs Limestone Member of the Pottsville Formation at locality 67 in Hocking County, Ohio. At this locality, the argillaceous nodular limestone has *P. ohioensis* n. sp. associated with *F. imprima* n. sp. The fusulinellid is a primitive form representing a stage of development similar to that of *F. primotina* n. sp. The form described as *F. pria* n. sp. from the Stoney Fork Member of the Breathitt Formation is also a primitive fusulinellid representing approximately the same early stage of development. The top of the zone of *Profusulinella* must be very close to the base of the Stoney Fork and to that of the Boggs. Again, as in Indiana, *Profusulinella* persisted in Ohio into the lower part of the zone of *Fusulinella*.

Other foraminifers commonly found in association with *Profusulinella* in the zone include *Climacammina* sp., *Tetrataxis* sp., *Millerella* sp., and, less commonly, *Pseudostaffella* sp..

ZONE OF *FUSULINELLA*

The upper part of the Atokan Series of Middle Pennsylvanian age is included in the zone of *Fusulinella*. The zone extends from the first occurence of *Fusulinella* to the first occurrence of *Beedeina (Fusulina* of previous use). The fact that *Fusulinella* evolved from *Pro-*

fusulinella through transition and evolved into *Beedeina* through transition makes the zone limits dependent on taxonomic and nomenclatural decisions. The evolutionary changes took place rapidly enough so that, in practice, there is no great problem in assigning stratigraphic units. The section in the type area of the Atokan Series in southern Oklahoma shows a sequence of beds containing several species of *Fusulinella* above the *Profusulinella* zone (Douglass and Nestell, 1984). The species present in Oklahoma are not represented in the Kentucky section, but *Fusulinella* sp. aff. *F. leyi*, described from near the top of the section, is of about the same stage of development as forms from the type Curlew Limestone Member of the Tradewater Formation in Kentucky.

The zone of *Fusulinella* in the Eastern Interior Basin is relatively restricted in the stratigraphic section. The Kentucky section includes several beds of the type Curlew Limestone Member at locality 17 in Union County that contain *F. iowensis* and *F. stouti*. This section also includes the slightly older horizon of the Curlew Limestone Member found at locality 21 that contains *F. primotina* n. sp.

The equivalent interval to the Curlew Limestone Member is the Seville Limestone Member of the Spoon Formation, which contains similar species. The zone of *Fusulinella* in Indiana includes beds in the upper part of the Brazil Formation and the Perth Limestone Member of the Staunton Formation. The form *Fusulinella*? is mentioned by Thompson and Shaver (1964, p. 17) from strata tentatively assigned to the Brazil Formation or possibly to the Perth Limestone Member of the Staunton Formation. The Staunton also contains *F. iowensis.*

The *Fusulinella* zone in the Appalachian Basin is represented through the upper part of the Pottsville Formation by the Boggs Limestone Member and the upper and lower Mercer Limestone Members in Ohio and by the Stoney Fork Member of the Breathitt Formation in eastern Kentucky. The fauna includes *P. ohioensis* and *F. imprima* in the Boggs Limestone and *F. pria* in the Stoney Fork Member.

Fusulinella and *Beedeina* occur together in several areas, but the zone of *Fusulinella* is restricted to the beds below the first occurrence of *Beedeina.*

ZONE OF *BEEDEINA*

The zone of *Beedeina* includes all the beds between the zone of *Fusulinella* and the zone of *Triticites.* This interval includes all the Desmoinesian Series of Middle Pennsylvanian age. The genus *Beedeina* is found throughout the zone as it evolves from a form differing only slightly from *Fusulinella* to the large, tightly fluted species of the latest Desmoinesian. The changes take place gradually through the zone, but some developmental stages are striking enough to allow for division of the zone into recognizable subzones.

SUBZONE OF *BEEDEINA LEEI*

Beedeina leei is common in the "Curlew" Limestone Member of the Spoon Formation in southern Illinois and is the only fusulinid reported from this bed. The "Curlew" is the first marine limestone above the Seville Limestone Member of the *Fusulinella* zone. The name "Curlew" is based on miscorrelation with the Curlew Limestone Member of Kentucky, which is equivalent in age to the Seville Limestone Member. *B. leei* is the species characteristic of the Putnam Hill Limestone Member of the Allegheny Formation in Ohio. Here again, this species is the only fusulinid reported from the bed, and this unit is the first marine limestone above the upper Mercer Limestone Member of the *Fusulinella* zone. Thompson (1936, p. 677, 678) assigned the Putnam Hill specimens to his new species *F. serotina* but recognized the more advanced septal fluting that has led to the assignment of these specimens to *Beedeina*. A similar set of specimens was collected from the Mahoning Limestone of Rogers (1858) at locality 87 in Armstrong County, Pa. *B. leei* occurs with *Beedeina* sp. at this locality. There is no direct correlation with the Putnam Hill Limestone Member, but the fusulinids suggest this lowest subzone of the Desmoinesian.

The Kentucky sections include *B. leei* at several places both in outcrop (locality 32) and in drill cores (localities 18, 35, and 40). The specimens come from an outcropping limestone that was thought to be "Curlew," from about 15 ft above the No. 4 coal at locality 32 in Christian County. The limestone below the coal here correlates with the Curlew Limestone Member and contains the *Fusulinella* fauna. At this locality, *B. leei* occurs with *Wedekindellina euthysepta* and may represent a younger horizon than the "Curlew" Limestone Member of Illinois and the Putnam Hill Limestone Member of Ohio.

The core samples from western Kentucky contain *Beedeina leei* and *B.* sp. aff. *B. leei* in several wells. At locality 18 in Union County, *B. leei* occurs as expected above the *F. iowensis* of the *Fusulinella* zone and below more advanced *Beedeina* with *W. euthysepta* in the Yeargins limestone member (informal usage) of the Tradewater Formation. The other drill-core samples show *B. leei* associated with a *Wedekindellina* sp. that cannot be further identified.

SUBZONE OF *WEDEKINDELLINA*

The genus *Wedekindellina* is found through the lower beds of the Desmoinesian series in both basins but is more common in the Eastern Interior Basin than in the

Appalachian Basin. The first occurrences are within the zone of *Beedeina leei,* as previously noted. The most common occurrences are in the Stonefort Limestone Member of the Spoon Formation and its equivalents in Illinois, the Yeargins limestone member of the Tradewater Formation in Kentucky, and the Vanport Limestone Member of the Allegheny Formation in Ohio and Pennsylvania. Reports of *Wedekindellina* in younger beds (Dunbar and Henbest, 1942, p. 30) are not included, because the specimens are now assigned to *Eowaeringella* Skinner and Wilde, 1967.

SUBZONE OF *BEEDEINA NOVAMEXICANA*

Beedeina novamexicana in known from Illinois in the Stonefort Limestone Member of the Spoon Formation. The Kentucky specimens related to this species are from the Yeargins limestone member (informal usage) of the Tradewater Formation. *Wedekindellina* is a common element in this subzone, as noted above. This subzone may be represented in the Appalacian Basin by the Vanport and Columbiana Limestone Members of the Allegheny Formation. The Vanport has *B. carmani* (Thompson) and *W. euthysepta,* and the Columbiana has *B. ashlandensis* n. sp. Both limestones correlate with the Yeargins limestone member of western Kentucky, but the *Wedekindellina* is the only fusulinid common to all these limestones.

SUBZONE OF *BEEDEINA GIRTYI*

Beedeina girtyi is common in the Brereton and Herrin Limestone Members of the Carbondale Formation in Illinois. The same subzone is represented in Kentucky in the Providence Limestone Member of the Sturgis Formation. No marine beds of equivalent age are known from the Appalachian Basin. The fusulinids of the *B. girtyi* subzone include *B. girtyi, B. haworthi,* and the specimens described by Dunbar and Henbest (1942) as *Fusulina illinoisensis* that are probably closely related to *B. girtyi.* Additional specimens that are approaching the stage of *B. acme* are found in some samples assigned to the Providence Limestone Member, but they have not developed the characteristic subcylindrical shape of that species.

SUBZONE OF *BEEDEINA ACME*

Beedeina acme is found in the marine limestone beds of the Modesto Formation in Illinois and in the Madisonville Limestone Member of the Sturgis Formation in Kentucky. The names Piasa, Cutler, and Lonsdale Limestone were used for these beds by Dunbar and Henbest (1942, p. 25, 26), leaving some question as to their relative stratigraphic position but placing them all in the latest part of the Desmoinesian sequence with the last representatives of *Beedeina* (their *Fusulina*). Dunbar and Henbest (1942) recognized five species of *Beedeina* (their *Fusulina*) in this unit, of which only *B. acme* is recognized in the Kentucky section. No marine horizons equivalent to these beds were found in the Appalachian Basin.

ZONE OF *TRITICITES*

The zone of *Triticites* includes all the rocks of Late Pennsylvanian (Missourian and Virgilian) age. It includes the rocks containing the first *Triticites,* but it does not include the upper limits of the range of the genus; *Triticites* also occurs in the overlying zones of *Schwagerina* and *Pseudoschwagerina.* Subzones of *Triticites* can be distinguished within the Eastern Interior and Appalachian Basins.

SUBZONE OF *TRITICITES OHIOENSIS*

Triticites ohioensis was described from the Brush Creek and Cambridge Limestone Members of the Conemaugh Formation in Ohio. The subzone includes the lowest beds of the Brush Creek in southern Ohio and eastern Kentucky, the Cambridge in Ohio, and probably the Portersville Member of the Conemaugh Formation in Ohio, from which Smyth (1957, p. 262) reported probable *T. ohioensis.* The equivalent interval in the Eastern Interior Basin includes the Shoal Creek and Livingston Limestone Members of the Bond Formation and the Omega Limestone Member of the Mattoon Formation in Illinois and the Carthage Limestone Member of the Sturgis Formation in Kentucky. Other fusulinids found in this subzone include *T. venustus* in Illinois, *T. kehni* n. sp. in Kentucky, and *T. smythi* n. sp. in Ohio.

SUBZONE OF *TRITICITES SKINNERI*

Triticites skinneri was described from the Ames Limestone Member of the Conemaugh Formation in Ohio. It is common in that unit and has been reported from the Gaysport Member (Smyth, 1957, p. 262), but that occurrence has not been verified. *T. skinneri* is associated with *T. ricei* n. sp. in the Ames Limestone Member. *T. cullomensis* was also reported from the Ames Limestone Member (Smyth, 1957, p. 273, 274) in Ohio, but the specimens illustrated (pl. 3, figs. 23, 24) are more properly assigned to *T. skinneri.* The specimens of *T. cullomensis* from Brilliant Cut in Pittsburgh, Pa., are referred to the Ames Limestone Member but may represent a slightly younger horizon. The Shumway Limestone Member of the Mattoon Formation in Illinois carries a faunna of *T. turgidus* and *T. pauper* that closely resemble *T. skinneri* in stage of development and probably represent the subzone.

SUBZONE OF *TRITICITES CALLOSUS*

The Greenup Limestone Member of the Mattoon Formation has a fusulinid fauna including *Triticites callosus* and *T. mediocris* that suggest a late developmental stage of the genus, approaching the *T. ventricosus* known from rocks of Early Permian age in the Midcontinent. This subzone is the youngest fusulinid unit known from the Illinois part of the Eastern Interior Basin, and it is only known from Cumberland County, Ill. (locality 1). No equivalent marine beds are known from the Apalachian Basin. Outcrops in western Kentucky do not include a marine horizon representing this subzone. The one drill core that might have penetrated the subzone (locality 19) did not have fusulinids to verify it.

SUBZONE OF *TRITICITES BEARDI*

A unit that in the Midcontinent could be called the zone of *Triticites ventricosus* is represented in the graben in the Rough Creek fault system. The unit is only known from one drill core and contains a form described as *T. beardi* n. sp. This form represents a developmental stage similar to forms described from rocks of Early Permian (Wolfcampian) age. No fusulinids of this age are known from other parts of either the Eastern Interior or Appalachian Basins.

CORRELATIONS BETWEEN THE EASTERN INTERIOR AND APPALACHIAN BASINS

An introduction to the correlations of units between the Eastern Interior and Appalachian Basins was presented by Rice, Kehn, and Douglass in 1979, on the basis of the studies completed at that time. Precise correlation of beds between the basins is not possible because sedimentation was not uniform in the separate basins and because marine beds are discontinuous even within each basin. Correlations are, nevertheless, possible on the basis of the faunal succession described. Figure 5 summarizes the correlations, showing the approximate equivalence of many of the named beds in five generalized sections. Correlation between beds that have no fusulinid faunas is not suggested, and the intervening beds are placed only approximately.

The succession will be treated from bottom to top, starting with the oldest beds that have fusiform fusulinids and moving upsection. The correlations possible for each fusulinid-bearing unit are indicated.

MIDDLE PENNSYLVANIAN

BEDS OF EARLY ATOKAN AGE

The oldest unit bearing fusiform fusulinids is the Lead Creek Limestone Member of the Tradewater Formation. This member is exposed in western Kentucky and in southern Indiana (not shown in fig. 5) and is known from several drill cores in western Kentucky. The member consists of several beds, two of which were called the Fulda and Ferdinand Limestone Members (Mansfield Formation) in Indiana by Thompson and Shaver (1964). These beds were later called the Ferdinand and Fulda Beds of the Lead Creek Limestone Member of the Mansfield Formation by Shaver and Smith (1974). Other older beds that might be considered to belong to this unit are found in some of the drill cores, but no names have been applied to them. No fusiform fusulinids of this age are known for Illinois or from the Appalachian Basin. The member probably correlates with strata of the Abbott Formation in Illinois and, perhaps, in part, with the Magoffin Member of the Breathitt Formation in Kentucky. Both the Lead Creek and the Magoffin are very close in age but are older than the Boggs Limestone Member of the Pottsville Limestone in Ohio.

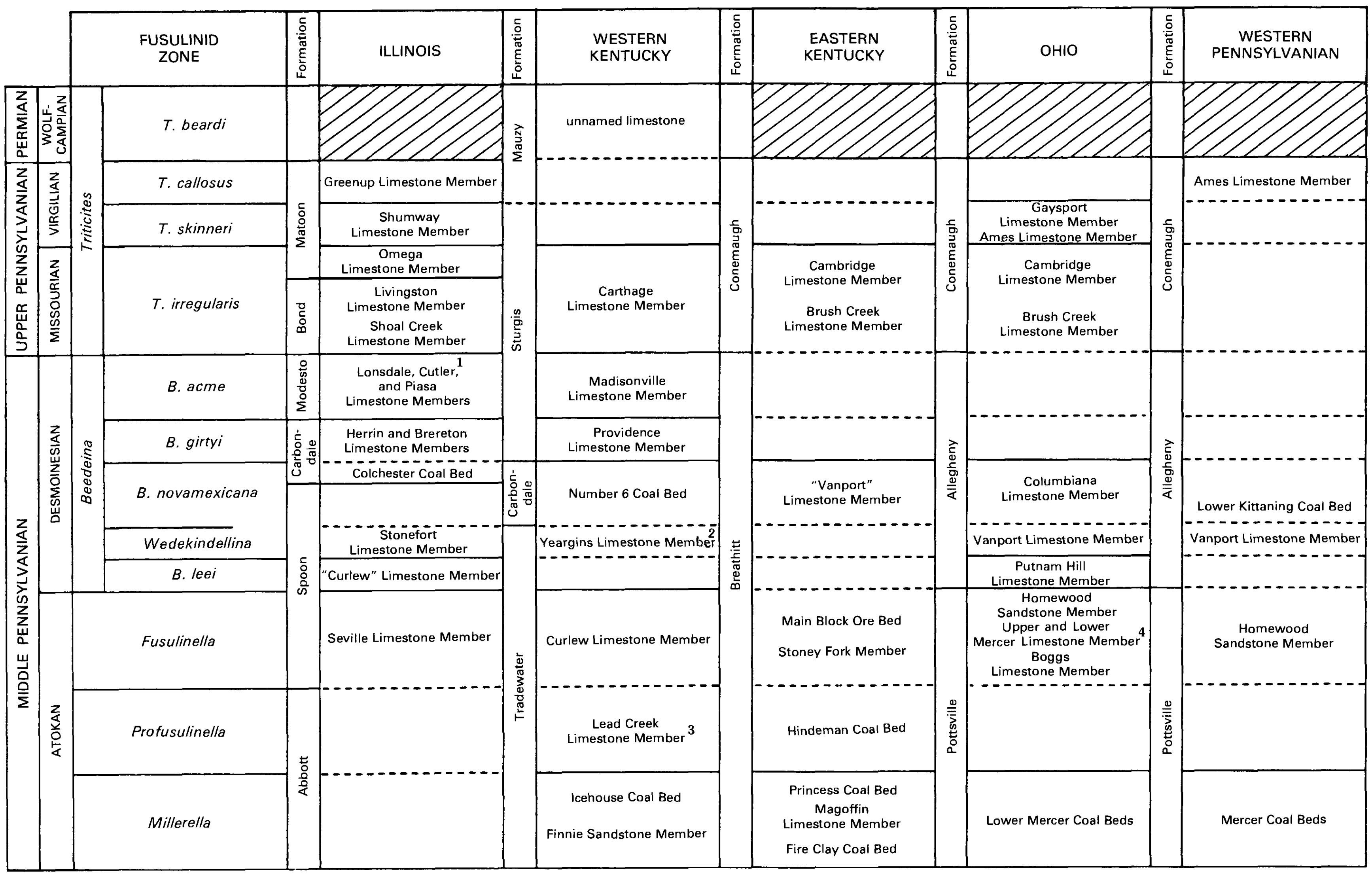
BEDS OF LATE ATOKAN AGE

A fairly close correlation can be made between the lowest beds of the Curlew Limestone Member of the Tradewater Formation at locality 21, the Stoney Fork Member of the Breathitt Formation in eastern Kentucky, and the Boggs Limestone Member of the Pottsville Formation in Ohio. Each of these units has a primitive *Fusulinella* intermediate between *Profusulinella* and typical fusulinellas. The species are distinct but closely related. No representatives of this level are known from surface exposures in the Eastern Interior Basin.

This level is commonly overlain in drill cores and in surfaces deposits of the Eastern Interior Basin by the Curlew Limestone Member of the Tradewater Formation as it is defined in Union County, Ky. The Curlew Limestone Member correlates with the Seville Limestone Member of the Spoon Formation in Illinois, the Perth Limestone Member of the Staunton Formation in Indiana, and the Mercer Limestone Member of the Pottsville Formation in Ohio. No fusulinid-bearing equivalents are known from eastern Kentucky.

BEDS OF EARLY DESMOINESIAN AGE

The beds called Curlew Limestone by Dunbar and Henbest (1942, p. 20), which are younger than the type Curlew of Kentucky, are probably correlative with the Creal Springs Limestone Member of the Spoon Formation (Wanless, 1975, p. 79). They correlate with the lower part of the Yeargins limestone member of the Tradewater Formation in surface and drill-core samples



1 Cutler now included in Piasa.
2. Informal usage.
3 Lead Creek Limestone of Crider, 1913.
4 As used by Smyth (1957).

Figure 5.–Correlation chart showing the relation of beds and the fusulind zones in parts of the Eastern Interior and Appalachian Basins. Modified from Rice, Kehn, and Douglass (1979).

and with the Putnam Hill Limestone Member of the Allegheny Formation in Ohio.

BEDS OF MIDDLE DESMOINESIAN AGE

The Stonefort Limestone Member of the Spoon Formation in Illinois correlates with the Yeargins limestone member of the Tradewater Formation in western Kentucky. The beds containing fusulinids of this general age in the Appalachian Basin have few species in common, and a precise correlation cannot be made. The Vanport and Columbiana Limestone Members of the Allegheny Formation in Ohio and Kentucky and the Vanport Limestone Member in Pennsylvania are all assigned a middle Desmoinesian age.

BEDS OF LATE DESMOINESIAN AGE

The Brereton and Herrin Limestone Members of the Carbondale Formation in Illinois correlate with the Providence Limestone Member of the Sturgis Formation in western Kentucky.

The Piasa, Cutler (now included in the Piasa), and Lonsdale Members of the Modesto Formation in Illinois correlate with the Madisonville Limestone Member of the Sturgis Formation in Kentucky.

No fusulinids of this age are known from the Appalachian Basin, but the upper beds of the Breathitt Formation in Kentucky and of the Allegheny Formation in Ohio should be equivalent in age.

UPPER PENNSYLVANIAN

BEDS OF MISSOURIAN AGE

The Shoal Creek and Livingston Limestone Members of the Bond Formation and the Omega Limestone Member of the Mattoon Formation in Illinois correlate approximately with the Carthage Limestone Member of the Sturgis Formation in western Kentucky. The Carthage Limestone Member probably represents the upper part of these beds. The Appalachian Basin equivalents are the several beds assigned to the Brush Creek and Cambridge Limestone Members of the Conemaugh Formation.

BEDS OF VIRGILIAN AGE

The Shumway Limestone Member of the Mattoon Formation in Illinois correlates with the Ames Limestone Member of the Conemaugh Formation in Ohio. No equivalents are known in eastern Kentucky. The Ames Limestone Member of Pennsylvania is probably a little younger than the Ames in Ohio.

The Greenup Limestone Member of the Mattoon Formation is younger than the Ames of Pennsylvania and is the youngest fusulinid horizon known from the Pennsylvanian of either basin.

LOWER PERMIAN

Strata of Early Permian age are known from only one locality in the Eastern Interior Basin (Kehn, Beard, and Williamson, 1982). Fusulinids of Early Permian age are from a drill core at locality 19 in Union County, Ky.

REGISTER OF LOCALITIES AND COLLECTIONS

[Localities are keyed to index map, fig 1]

Locality	Collection	
		ILLINOIS
1	f13995	Cumberland County. Pennsylvanian-Permian. 1,100 ft from north line and 1,900 ft from east line sec. 3, T. 9 N., R. 9 E., Toledo 15-min Quadrangle. Approx. 1 mi northwest of Greenup, about 300 ft north of Illinois Highway 121. T.M. Kehn colln. KB-42. *Triticites callosus, T. mediocris.*
	f14012	Cumberland County. Upper Pennsylvanian. Approx. 1 mi airline northwest of Greenup. About 2,150 ft from east line and 1,900 ft from north line sec. 3, T. 9 N., R. 9 E., Toldeo 15-min Quadrangle. Greenup Limestone Member of Mattoon Formation. H. Schwalb and J. Beard colln. KB-44. *Triticites callosus, T. mediocris.*
	f14013	Cumberland County. Upper Pennsylvanian. Re-collection of KB-42 (f13995) in the Greenup Limestone Member. T.M. Kehn colln. KB-41, re-collection at same locality but from bed about 4 ft lower in section. *Triticites callosus, T. mediocris.*
2	f13875	Williamson County. Middle Pennsylvanian. NE¼,SE¼, sec. 25, T. 10 S., R. 4 E., Harrisburg 15-min Quadrangle. Type locality for Stonefort Limestone Member of Spoon Formation. T.M. Kehn, collector, 1977. *Wedekindellina euthysepta, Beedeina* sp. aff. *B. novamexicana.*
	f13988	Williamson County. Middle Pennsylvanian. Stonefort Limestone Member type locality. Sec. 25, T. 10 S., R. 4 E., Harrisburg 15-min Quadrangle at Dunbar and Henbest Station 371. Limestone above 3–4 ft of black platy shale with light-gray plastic clay shale at base and overlain by sandstone. C.L. Rice colln. KG-78-6. *Wedekindellina euthysepta, Beedeina* sp. aff. *B. novamexicana.*
3	f13996	Saline County. Middle Pennsylvanian. Bankston Fork Limestone Member of Carbondale Formation near Henbest Station 233 in 1- to 3-ft-thick limestone in old strip pit.

REGISTER OF LOCALITIES AND COLLECTIONS—Continued

Locality Collection

ILLINOIS–Continued

Sec. 3, T. 9 S., R. 6 E., 50 ft from south line and 600–1,000 ft from west line of Harrisburg Quadrangle. J. Beard, collector, 1978. *Beedeina* sp.

4 _____f13989 ____Saline County. Middle Pennsylvanian. Type "Curlew" of Illinois. West side of SW¼NW¼NW¼ sec. 27, T. 10 S., R. 6 E., Harrisburg 15-min Quadrangle. Dunbar and Henbest (1942) Station 234. C.L. Rice colln. KG–78–6. *Beedeina leei.*

5 _____f13987 _____Saline County. Middle Pennsylvanian. Creal Springs Limestone Member of Spoon Formation type locality. Old sandstone quarry in SW¼SW¼ sec. 30, T. 10 S., R. 3 E., Harrisburg 15-min Quadrangle. C.L. Rice colln. KG–78–6. *Wedekindellina euthysepta, Beedeina* sp.

6 _____f13999 _____Saline County. Middle Pennsylvanian. Herrin Limestone Member at Henbest Station 377. Sec. 31, T. 9 S., R. 6 E., 1,900 ft from north line and 1,300 ft from west line of Harrisburg Quadrangle. 2½ to 3 ft of limestone above water in old strip pit. J. Beard, collector, 1978. *Beedeina* sp. aff. *B. haworthi.*

7 _____f14011 ____Gallatin County. Upper Pennsylvanian. In town limits of New Haven, along south bank of Wabash River. 1,200 ft from east line and 100 ft from south line of sec. 17, T. 7 S., R. 10 E., Emma 7½-min Quadrangle. Shoal Creek Limestone Member of Bond Formation. J. Beard colln. KB–39. *Triticites* sp. aff. *T. venustus.*

INDIANA

8 _____f13948 ____Dubois County. Middle Pennsylvanian. North side of road, 700 ft west and 6,500 ft south of northeast corner of Dale 7½-min Quadrangle, just east of pipeline. C.L. Rice colln. RF–d from float blocks of Lead Creek Limestone Member of Mansfield Formation from excavation of pipeline trench? *Millerella* sp., *Profusulinella kentuckyensis.*

9 _____f13949 ____Spencer County. Middle Pennsylvanian. Indiana Highway 545 roadcut in SW¼NE¼SW¼ sec. 11, T. 5 S., R. 4 W., Fulda 7½-min Quadrangle, 1½ mi south of Fulda on northeast side of road intersection at 540-ft altitude. C.L. Rice colln. RF–1 through 2½ ft of Lead Creek Limestone Member. *Profusulinella kentuckyensis.*

10 _____f13947 ____Spencer County. Middle Pennsylvanian. Limestone on west side of road at about 465 ft altitude in NE¼ sec. 20, T. 6 S., R. 4 W., Lewisport 7½-min Quadrangle. Probably same lociality as Shaver and Smith (1974) locality 28. Fulda Bed of Lead Creek Limestone Member. C.L. Rice colln. RF–2. *Millerella* sp., *Profusulinella kentuckyensis.*

f13980 ____Spencer County. Middle Pennsylvanian. 1,850 ft east and 650 ft south of northwest corner sec. 20, T. 6 S., R. 4 W., Huff Township, in northeast corner of Lewisport 7½-min Quadrangle. Float block of Lead Creek Limestone Member at locality 28 of Shaver and Smith (1974, p. 34). C.L. Rice, collector, 1978. *Millerella* sp., *Profusulinella kentuckyensis.*

KENTUCKY

11 _____f13907 ____Hancock County. Middle Pennsylvania. Core hole Gil-1, Tell City Quadrangle, Kentucky-Indiana, approx. 6 mi southwest of Tell City, Ind. Approx. 4,100 ft from west boundary and 12,900 ft from south boundary of quadrangle. T.M. Kehn colln. KG–77–7. Core sample at depth of 119.4 ft. *Millerella* sp., *Profusulinella* sp.

f13908 ____Hancock County. Middle Pennsylvanian. Same locality as f13907, but core sample at depth of 120 ft. T.M. Kehn colln. KG–77–7. *Millerella* sp., *Profusulinella kentuckyensis.*

f13909 ----Hancock County. Middle Pennsylvanian. Same locality as f13907, but core sample at depth of 122.6 ft. T.M. Kehn colln. KG–77–7. *Millerella* sp., *Profusulinella kentuckyensis.*

f13910 ____Hancock County. Middle Pennsylvanian. Same locality as f13907, but core sample at depth of 145.2 ft. T.M. Kehn colln. KG–77–7. *Millerella* sp., *Profusulinella kentuckyensis.*

f13911 ____Hancock County. Middle Pennsylvanian. Same locality as f13907, but core sample at depth of 148.5 ft. T.M. Kehn colln. KG–77–7. *Millerella* sp., *Profusulinella kentuckyensis.*

12 _____f14080 ____Hancock County. Middle Pennsylvanian. About 6,000 ft west of Petri, 700 ft south of U.S. Highway 60, 18,550 ft from south boundary and 14,200 ft from west boundary of Tell City 7½-min Quadrangle (GQ–356). Well started at 490-ft altitude. Sampled at 39 ft. T.M. Kehn, collector, 1979. *Millerella* sp., *Profusulinella kentuckyensis.*

f14081 ____Hancock County. Middle Pennsylvanian. Same locality as f14080, but sectioned at 37 ft. T.M. Kehn, collector, 1979. *Millerella* sp., *Profusulinella kentuckyensis.*

f14082 ____Hancock County. Middle Pennsylvanian. Same locality as f14080, but sectioned at 35 ft. T.M. Kehn, collector, 1979. *Millerella* sp., *Profusulinella kentuckyensis.*

13 _____f13922 ____Daviess County. Middle Pennsylvanian. Carter coordinates, sec. 7, Q-31, 1,250 ft from north line and 1,225 ft from east line.

REGISTER OF LOCALITIES AND COLLECTIONS—Continued

Locality	Collection	
		KENTUCKY–Continued
		About 4.5 mi southwest of Lewisport. Rockport and Lewisport Quadrangles. Core hold Gil-28. at 43.1 ft. T.M. Kehn colln. KG-77-7. *Millerella* sp., *Profusulinella kentuckyensis.*
	f13923	Daviess County. Middle Pennsylvanian. Same locality as f13922, but depth of 46.3 ft. T.M. Kehn, colln. KG-77-7. *Millerella* sp., *Profusulinella kentuckyensis.*
	f13924	Daviess County. Middle Pennsylvanian. Same locality as f13922, but depth of 70.6-76.5 ft. T.M. Kehn, colln. KG-77-7. *Millerella* sp., *Profusulinella kentuckyensis.*
14	f13632	Hancock County. Middle Pennsylvanian. Lead Creek Limestone Member, 7,300 ft from south line and 15,400 ft from west line of Tell City Quadrangle. Approx. 3.75 mi west of Hawesville in roadcut of paved county road. Limestone 0-20 ft above Lead Creek coal bed (not exposed). T.M. Kehn colln. KB-7-1 from lower 6 in. of 1-ft limestone. Same locality as Thompson and Shaver (1964) locality 58. *Millerella* sp., *Profusulinella kentuckyensis.*
	f13981	Hancock County. Middle Pennsylvanian. Carter coordinates sec. 25, R-33, 900 ft from north line and 1,800 ft from west line, Tell City 7½-min Quadrangle. Ferdinand Bed of the Lead Creek Limestone Member, Tradewater Formation. C.L. Rice, collector, 1978. *Millerella* sp., *Profusulinella kentuckyensis.*
15	f13921	Daviess County. Middle Pennsylvanian. Carter coordinates sec. 1, N-27, 1,400 ft from north line and 550 ft from east line. About 13,700 ft from south and 550 ft from east boundary of Curdsville Quadrangle. Core hole Gil-27. a) 203.6-204.0-ft depth. b) 244.7-248.8-ft depth. T.M. Kehn colln. KG-77-7. *Beedeina* sp.
16	f13982	Union County. Upper Pennsylvanian. 8,000 ft from south line and 4,350 ft from west line of Uniontown Quadrangle boundary on north bank of Sibley Creek. Approx. 6,000 ft southeast of east point of Wabash Island. Carter coordinates sec. 16, P-19, 2,750 ft from south line, 16,000 ft from east line. Carthage Limestone Member of Sturgis Formation. T.M. Kehn colln. B-1. *Triticites kehni.*
17	f13629	Union County. Middle Pennsylvanian. Type locality for Curlew Limestone Member on south side of southeast end of Indian Hill, altitude 435 ft, approx. 1 mi southwest of Dekoven, 23,300 ft from north line and 12,200 ft from west line of Dekoven Quadrangle boundary. Approx. 20 ft above No. 4 coal bed (not exposed) and 40 ft below sandstone capping hill. Limestone about 3 ft thick. Sample from basal 1 ft. T.M. Kehn colln. KB-1. *Fusulinella stouti, F. iowensis.*
	f13896	Union County. Middle Pennsylvanian. South side of southwest end of Indian Hill, altitude 370 ft. Approx. 1 mi southwest of Dekoven. Curlew Limestone Member of Tradewater Formation, approx. 8 ft below sandstone capping hill. T.M. Kehn colln. KB-26. *Fusulinella iowensis.*
	f13897	Union County. Middle Pennsylvanian. East side of Indian Hill, 23,300 ft from north line and 12,200 ft from west line of Dekoven Quadrangle boundary. Lowest limestone exposed. About 6-8 in. of flaggy limestone below 3-ft limestone bed 30-35 ft below sandstone capping hill. T.M. Kehn colln. KB-1-a. *Fusulinella stouti, F. iowensis.*
	f13898	Union County. Middle Pennsylvanian. Same locality as above, but collected from 3-ft limestone. T.M. Kehn colln. KB-1-b. *Fusulinella stouti, F. iowensis.*
	f13899	Union County. Middle Pennsylvanian. Same locality as f13897, but collected from small patch of limestone about 2-ft square in saddle of ridge and about 30 ft above the other limestone. T.M. Kehn colln. KB-1-c. *Fusulinella stouti, F. iowensis.*
18	f13743	Union County. Middle Pennsylvanian. 2,100 ft from west line and 1,950 ft from south line of Dekoven 7½-min Quadrangle. Altitude 414 ft. Drill hole Gil-15, depth 374-375 ft. C.L. Rice, collector, 1976. *Fusulinella iowensis.*
	f13744	Union County. Middle Pennsylvanian. Same locality as f13743, but depth of 267 ft. C.L. Rice, collector, 1976. *Wedekindellina euthysepta, Beedeina leei.*
	f13745	Union County. Middle Pennsylvanian. Same locality as f13743, but depth of 65 ft. C.L. Rice, collector, 1976. *Wedekindellina euthysepta, Beedeina* sp. aff. *B. novamexicana.*
19	f13876	Union County. Upper Pennsylvanian. Carter coordinates sec. 13, N-20, 300 ft from south line and 1,700 ft from east line in northwest corner of Bordley 7½-min Quadrangle. Altitude 455 ft, total depth drilled 1,841.05 ft, depth 194.4 ft. Limestone. T.M. Kehn, collector, 1977. *Triticites beardi.*
	f13877	Union County. Upper Pennsylvanian. Same locality as f13876, but depth of 194.7 ft. T.M. Kehn, collector, 1977. *Triticites* sp.
	f13878	Union County. Upper Pennsylvanian. Same locality as f13876, but depth of 932.6 ft. T.M. Kehn, collector, 1977. *Triticites* sp.
	f13879	Union County. Upper Pennsylvanian. Same locality as f13876, but depth of 933.2 ft. T.M. Kehn, collector, 1977. *Triticites* sp.

REGISTER OF LOCALITIES AND COLLECTIONS—Continued

Locality Collection

KENTUCKY–Continued

20 _____f13633 ____Crittenden County. Middle Pennsylvania. Curlew Limestone Member of Tradewater Formation. Approx. 5.3 mi west of Providence, north bank of Kentucky Highway 120, south side of Bald Hill, approx. 10,300 ft from south line and 4,600 ft from west line of Providence Quadrangle boundary. Same locality as No. 61 of Thompson and Shaver (1964). T.M. Kehn colln. KB-2-1 from 6 in. of fossililferous limestone at base of lower 3-ft limestone. *Fusulinella stouti.*

21 _____f13925 ____Webster County. Middle Pennsylvanian. Carter coordinates sec. 3, K-21, 550 ft from east line and 2,400 ft from south line. About 11,400 ft from south and 10,200 ft from east boundary of Providence Quadrangle. About 7,500 ft northwest of Providence. Core hole Gil-31. Depth 398.1-398.4 ft. T.M. Kehn, collector, 1977. *Wedekindellina euthysepta, Beedeina* sp. aff. *B. leei.*

f13926 ____Webster County. Middle Pennsylvanian. Same locality as f13925, but depth of 469.0-469.4 ft. T.M. Kehn, collector, 1977. *Fusulinella iowensis.*

f13927 ____Webster County. Middle Pennsylvanian. Same locality as f13925, but depth of 471.5-471.7 ft. T.M. Kehn, collector, 1977. *Fusulinella primotina.*

f13928 ____Webster County. Middle Pennsylvanian. Same locality as f13925, but depth of 506.0 ft. T.M. Kehn, collector, 1977. *Millerella* sp., *Profusulinella kentuckyensis.*

22 _____f13977 ____Webster County. Upper Pennsylvanian. 22,000 ft from north line and 16,000 ft from west line of Nebo Quadrangle boundary (GQ-777). Approx. 4 mi northeast of Providence. Limestone reported as 2-4 ft thick, partly exposed in sinkhole at altitude 410 ft. T.M. Kehn colln. 0-16-176. *Triticites kehni.*

f13984 ____Webster County. Middle Pennsylvanian. 22,000 ft from north line and 15,900 ft from west line of Nebo Quadrangle boundary. Carter coordinates sec. 19, L-22, 2,200 ft from south line, 1,400 ft from west line. Approx. 4.75 mi northwest of Nebo. Carthage Limestone Member of Sturgis Formation about 6 ft thick, exposed in sinkhole. T.M. Kehn colln. F-178. *Triticites kehni.*

23 _____f13915 ____Hopkins County. Middle Pennsylvanian. Carter coordinates sec. 22, J-21, 50 ft from north line and 2,100 ft from west line. About 6,000 ft from south and 7,600 ft from east boundary of Dalton Quadrangle. Core hole Gil-17, sample from 230.2-ft depth. T.M. Kehn, collector, 1977. *Wedekindellina* sp.

REGISTER OF LOCALITIES AND COLLECTIONS—Continued

Locality Collection

KENTUCKY–Continued

24 _____f13946 ____Caldwell County. Middle Pennsylvanian. Roadcut on north side of Route 293 across from Felker Cemetery. 17,600 ft from west line and 17,300 ft from south line of Dalton Quadrangle (GQ-490). C.L. Rice colln. JD from limestone in fault block about 100 ft above a coal bed. 1977. *Millerella* sp., *Profusulinella* sp.

25 _____f13916 ____Hopkins County. Middle Pennsylvanian. Carter coordinates sec. 23, J-23, 2,025 ft from south line and 2,300 ft from west line. About 2,000 ft from south boundary and 200 ft from east boundary of Coiltown Quadrangle. Core hole Gil-18, sample from 283.9 ft depth. T.M. Kehn, collector, 1977. *Wedekindellina* sp., *Beedeina* sp.

26 _____f13872 ____Hopkins County. Middle Pennsylvanian. Approx. 18,250 ft from north line and 5,600 ft from west line of Madisonville East 7½-min Quadrangle. East side of Madisonville, 800 ft south of Center St. and adjacent to Louisville and Nashville Railroad tracks, west side of Madison Square shopping center. Madisonville Limestone Member of Sturgis Formation. Four samples in descending order through about 14 ft of basal part of member. T.M. Kehn colln. KB-16-4, 1-2-ft limestone at base of member below 2-ft shale break. Orange-weathering gray silty limestone. *Beedeina acme.*

f13873 ____Hopkins County. Middle Pennsylvanian. Approx. 15,800 ft from north line and 15,800 ft from east line of Madisonville West 7½-min Quadrangle. In strip-mine highwall No. 14 coal bed, 2 mi west of Madisonville. Madisonville Limestone Member of Sturgis Formation lower beds. T.M. Kehn colln. KB-19-3. Lower 6-in. limestone below shale break in lower part of Madisonville Limestone Member. *Beedeina* sp.

27 _____f13785 ____Hopkins County. Middle Pennsylvanian. Providence Limestone Member of Sturgis Formation from approx. 300 ft north of main intersection in Earlington and within the city limits. 400 ft from north line, 600 ft from west line of Madisonville West 7½ min Quadrangle. Carter coordinates sec. 20, J-24. From 40-in. fossiliferous limestone just below No. 12 coal bed and 6 in. above top of No. 11 coal bed. T.M. Kehn colln. K224-2. *Beedeina girtyi.*

f13786 ____Hopkins County. Middle Pennsylvanian. Same locality as f13785, but from 12-in. fossiliferous limestone above No. 12 coal bed, which is 14 in. thick. T.M. Kehn colln. K224-1. *Beedeina* sp.

28 _____f13874 ____Hopkins County. Middle Pennsylvanian. Approx. 20,450 ft from north line and 9,400

REGISTER OF LOCALITIES AND COLLECTIONS — Continued

Locality	Collection	
		KENTUCKY – Continued
		ft from east line of Madisonville East 7½-min Quadrangle. Approx. 4 mi east of Madisonville in high wall of Cimeron strip mine on Nos. 11, 12, and 13 coal beds. Providence Limestone Member of Sturgis Formation. T.M. Kehn colln. KB-20-1 from 3-ft limestone at base of formation. *Beedeina girtyi, B.* sp. aff. *B. acme.*
29	f13782	Muhlenberg County. Middle Pennsylvanian. USGS loc. 23770-PC (field no. P-19-270). Millport 7½-min Quadrangle. Vogue Mine (13-j-26). Lat 37°17.69′ N., long 87°22.42′ W. 1,900 ft from north line and 1,850 ft from east line. Millport 7½-min Quadrangle. Providence Limestone Member of Sturgis Formation. G.J. Franklin, collector, 9-11-69. *Beedeina girtyi.*
	f13783	Muhlenberg County. Middle Pennsylvanian. USGS loc. 23771-PC (field no. P-19-273). Vogue Mine (13-J-26). Lat 37°17.75′ N., long 87°22.49′ W. 1,530 ft from north line and 2,350 ft from east line, Millport 7½-min Quadrangle. Providence Limestone Member of Sturgis Formation. G.J. Franklin, collector, 9-11-69. *Beedeina* sp.
	f13784	Muhlenberg County. Middle Pennsylvanian. USGS loc. 23774-PC (field no. P-19-290). Vogue Mine (19-J-26). Lat 37°16.81′ N., long 87°21.68′ W. 1,250 ft from north line and 1,650 ft from east line, Millport 7½-min Quadrangle. Providence Limestone Member of Sturgis Formation. G.J. Franklin, collector, 9-23-69. *Beedeina* sp. aff. *B. haworthi.*
30	f13903	Muhlenberg County. Middle Pennsylvanian. Carter coordinates sec. 13, I-27, 800 ft. from north line, 1,500 ft from east line, Graham 7½-min Quadrangle. Approx. 1 mi south of Yeargins Chapel, in roadbank (Kentucky Highway 175) and approx. 500 ft north of Illinois Central Railroad crossing. Yeargins limestone member (informal usage) below No. 6. coal. T.M. Kehn colln. KB-22. *Beedeina* sp.
31	f13740	Christian County. Middle Pennsylvanian. 2,500 ft from north line and 150 ft from east line, Dawson Springs SE 7½-min Quadrangle. Altitude 554 ft. Depth of 181-184 ft. Core hole DDH, G16. C.L. Rice, collector, 1976. *Profusulinella kentuckyensis.*
	f13741	Christian County. Middle Pennsylvanian. Same locality as f13740, but depth of 36-38 ft. Core hole DDH, G16. C.L. Rice, collector, 1976. *Wedekindellina euthysepta, Beedeina* sp. aff. *B. spissiplicata.*
	f13741B	Christian County. Middle Pennsylvanian. Same locality as f13740, but depth of 74.5 ft. C.L. Rice, collector, 1976. *Fusulinella iowensis.*
	f13742	Christian County. Middle Pennsylvanian. Same locality as f13740, but depth of 4.1-4.3 ft. Core hole DDH, G16. C.L. Rice, collector, 1976. *Wedekindellina euthysepta, Beedeina* sp. aff. *B. leei.*
32	f13635	Christian County. Middle Pennsylvanian. Approx. 2,500 ft northwest of Empire. 12,200 ft from north line and 1,800 ft from east line of Dawson Springs SE Quadrangle. From top of limestone 0-40 ft below No. 4 coal bed. Limestone 5-15 ft. T.M. Kehn colln. KB-3 from lower 5 ft of fossiliferous limestone. *Fusulinella stouti, Fusulinella* sp., *F. iowensis.*
	f13636	Christian County. Middle Pennsylvanian. Northwest of Empire, approx. 400 ft northwest of f13635 (KB-3). 11,800 ft from north line and 2,450 ft from east line of Dawson Springs SE Quadrangle. "Curlew Limestone" 4 ft thick about 15 ft above base of No. 4 coal bed and associated overlying shale. T.M. Kehn colln. KB-4, pieces of limestone and some picked fusulinids. *Wedekindellina euthysepta, Beedeina leei.*
	f13983	Christian County. Middle Pennsylvanian. 12,200 ft from north boundary and 2,600 ft from east boundary of Dawson Springs SE Quadrangle (GQ-1365). T.M. Kehn colln. B-2. *Beedeina* sp. aff. *B. leei.*
33	f13917	Muhlenberg County. Middle Pennsylvanian. Carter coordinates sec. 15, I-31, 1,550 ft from north line and 2,000 ft from east line. About 13,500 ft from north boundary and 2,700 ft from west boundary of Rochester Quadrangle. Core hole Gil-19, 282.8-ft depth. T.M. Kehn colln. KG-77-7. *Wedekindellina* sp., *Beedeina* sp.
	f13918	Muhlenberg County. Middle Pennsylvanian. Same locality as f13917, but depth of 284 ft. T.M. Kehn, collector, 1977. *Beedeina* sp.
	f13749	Muhlenberg County. Middle Pennsylvanian. 3,080 ft from west line and 1,640 ft from south line, Rochester 7½-min Quadrangle. Altitude 483 ft. Core hole DDH, G10, at depth of 293-296 ft. C.L. Rice, collector, 1976. *Profusulinella kentuckyensis.*
	f13750	Muhlenberg County. Middle Pennsylvanian. Same locality as f13749, but depth of 150 ft. C.L. Rice, collector, 1976. *Beedeina* sp. aff. *B. spissiplicata.*
34	f13913	Butler County. Middle Pennsylvanian. Lead Creek Limestone Member of Tradewater Formation from core hole Gil-12 about 4,000 ft southeast of Rochester. Carter coordinates sec. 13, I-32, 22,800 ft from south line and 1,025 ft from west line. About 16,000 ft from north boundary and 1,400 ft from east boundary of Rochester Quadrangle

REGISTER OF LOCALITIES AND COLLECTIONS—Continued

Locality Collection

KENTUCKY–Continued

(GQ–1171). At 147.6-ft depth. T.M. Kehn, collector, 1977. *Millerella* sp., *Profusulinella* sp.

f13914 ____Butler County. Middle Pennsylvanian. Same locality as f13913, but depth of 148.5 ft. T.M. Kehn, collector, 1977. *Millerella* sp., *Profusulinella kentuckyensis.*

35 _____f13919 ____Butler County. Middle Pennsylvanian. Carter coordinates sec. 25, J–33, 1,700 ft from north line and 1,050 ft from west line. About 4,400 ft from south boundary and 13,200 ft from west boundary of Cromwell Quadrangle. Core hole Gil–23, at depth of 177.6–177.8 ft. T.M. Kehn, collector, 1977. *Beedeina leei, B.* sp. aff. *B. spissiplicata.*

f13920 ____Butler County. Middle Pennsylvanian. Same locality as f13919, but depth of 371.2 ft. T.M. Kehn, collector, 1977. *Millerella* sp., *Profusulinella kentuckyensis.*

36 _____f13630 ____Butler County. Middle Pennsylvanian. "Curlew Limestone" approx. 20 ft above No. 4 coal bed, 1,500 ft from north line and 18,500 ft from east line of Morgantown Quadrangle. West side of U.S. Highway 231, approx. 600 ft north of north end of highway bridge over Green River. Same as locality Ky–2 and Ky–3 of Thompson and Shaver (1964). T.M. Kehn colln. KB–5–1. 1975. *Profusulinella kentuckyensis.*

f13631 ____Butler County. Middle Pennsylvanian. Same locality as f13630, but lower 6 in. of 3-ft limestone. T.M. Kehn, colln. KB–5–2. 1975. *Profusulinella kentuckyensis.*

f13900 ____Butler County. Middle Pennsylvanian. West side of U.S. Highway 231, approx. 600 ft north of north end of bridge over Green River. Approx. 1.4 mi north of Morgantown. New exposures at locality KB–5 (f13630–1). KB–5A from 6 in. limestone at base of principal limestone and separated from it by 2–3 in. of clay shale. T.M. Kehn, collector, 1977. *Millerella* sp., *Profusulinella kentuckyensis.*

f13901 ____Butler County. Middle Pennsylvanian. Same locality as f13900, but KB–5B from upper limestone approx. 20 in. thick. T.M. Kehn, collector, 1977. *Profusulinella kentuckyensis.*

f13994 ____Butler County. Middle Pennsylvanian. 18,600 ft from north line and 15,850 ft from west line of quadrangle border. Approx. 11,000 ft southeast of Pleasant Rock Church. Carter coordinates sec. 19, I–34, 500 ft from north line and 1,400 ft from west line of Morgantown 7½-min Quadrangle. T.M. Kehn colln. KB–40. *Profusulinella kentuckyensis.*

f14034 ____Butler County. Middle Pennsylvanian. Carter coordinates sec. 19, I–34, 1,300 ft from west line and 800 ft from north line, Morgantown 7½-min Quadrangle. Shale between the two limestone beds of Morgantown limestone (informal usage) at or near KB–40 (f13994). J. Beard, collector, 1979. *Millerella* sp., *Profusulinella kentuckyensis.*

37 _____f13746 ____Butler County. Middle Pennsylvanian. 1,730 ft from east line and 1,520 ft from south line, South Hill 7½-min Quadrangle, altitude 535 ft. Depth 168 ft. C.L. Rice, collector, 1976. *Millerella* sp., *Profusinella kentuckyensis.*

38 _____f13747 ____Ohio County. Middle Pennsylvanian. 2,700 ft from south line and 500 ft from east line, Flener 7½-min Quadrangle. Altitude 570 ft. Depth of 199 ft. C.L. Rice, collector, 1976. *Millerella* sp., *Profusulinella kentuckyensis.*

f13748 ____Ohio County. Middle Pennsylvanian. Same locality as f13747, but depth of 143 ft. C.L. Rice, collector, 1976. *Millerella* sp., *Profusulinella kentuckyensis.*

39 _____f13904 ____Butler County. Middle Pennsylvanian. Approx. 2,200 ft south of Green River Parkway bridge over Green River and approx. 4,400 ft from south boundary and 1,200 ft from west boundary of Flener Quadrangle (GQ–1049). T.M. Kehn, colln. KB–23. *Beedeina* sp. aff. *B. novamexicana.*

f13905 ____Butler County. Middle Pennsylvanian. East bank of Green River Parkway. Approx. 1.4 mi south of bridge over Green River, 1,200 ft south of Kentucky Highway 403 bridge over parkway. Flener Quadrangle. Mapped as near No. 6 coal. T.M. Kehn colln. KB–25A. *Wedekindellina euthysepta.*

f13906 ____Butler County. Middle Pennsylvanian. Same locality as f13905, but in 1–2-ft limestone 3½ ft above KB–25A. T.M. Kehn, colln. KB–25B. *Wedekindellina euthysepta, Beedeina* sp. aff. *B. leei.*

40 _____f13751 ____Ohio County. Middle Pennsylvanian. 2,600 ft from south line and 2,250 ft from west line, Cromwell 7½-min Quadrangle. Core Gil–9 at depth of 332 ft. C.L. Rice, collector, 1976. *Beedeina* sp. aff. *B. spissiplicata.*

f13752 ____Ohio County. Middle Pennsylvanian. Same locality as f13751, but depth of 313–316 ft. C.L. Rice, collector, 1976. *Wedekindellina euthysepta, Beedeina* sp. aff. *B. novamexicana.*

f13753 ____Ohio County. Middle Pennsylvanian. Same locality as f13751, but depth of 185 ft. C.L. Rice, collector, 1976. *Beedeina leei.*

41 _____f13902 ____Ohio County. Middle Pennsylvanian. Carter coordinates sec. 14, K–33, 500 ft from north line and 600 ft from west line. North bank of Western Kentucky Parkway. Ap-

REGISTER OF LOCALITIES AND COLLECTIONS—Continued

KENTUCKY–Continued

Locality	Collection	
		prox. 4,000 ft east of parkway service plaza. Horton Quadrangle. Limestone below No. 6 coal bed. T.M. Kehn colln. KB-21. *Wedekindellina euthysepta, Beedeina* sp. aff. *B. novamexicana.*
42	f14098	Ohio County. Middle Pennsylvanian. West side of Green River Turnpike at altitude 480 ft. Carter coordinates sec. 16, J-34, 3,000 ft from north line and 1,100 ft from west line; at 9,100 ft from south line and 1,100 ft from west line of Cromwell Quadrangle. J. Beard colln. 79-11. *Beedeina* sp.
43	f14097	Ohio County. Middle Pennsylvanian. On Green River Turnpike 1,700 ft northwest of intersection. West U.S. 62 on southwest side of turnpike. Carter coordinates sec. 21, L-32, 1,500 ft from west line and 1,650 ft from north line; 8,850 ft from west line and 19,500 ft from south line of Horton Quadrangle. J. Beard colln. 79-12. *Fusulinella iowensis.*
44	f13912	Ohio County. Middle Pennsylvanian. Core hole Gil-6. Carter coordinates sec. 24, N-32, 850 ft from north line and 600 ft from east line. About 9,900 ft from north boundary and 3,000 ft from east boundary of Pleasant Ridge Quadrangle (GQ-766). Sample from 45.4-ft depth in Lead Creek Limestone Member of Tradewater Formation. T.M. Kehn, collector, 1977. *Profusulinella* sp.
45	f14099	Bell County. Middle Pennsylvanian. Core from drill hole 11,850 ft east and 19,350 ft north of southwest corner of Beverly 7½-min Quadrangle. Sample from 56 ft above Hazard Coal bed. C.L. Rice colln. 79-10. *Fusulinella pria.*
46	f13574	Bell County. Middle Pennsylvanian. Kentucky coordinates 211,250 N., 2,640,550 E., Beverly Quadrangle, on strip bench west of Kentucky Highway 1201, about 2¼ mi southwest of Beverly at head of Red Bird Creek. Russell Ping colln. LC3-2. Jan. 19, 1975. *Fusulinella pria.*
	f13570	Bell County. Middle Pennsylvanian. Russell Ping colln. LC3-3 at same locality but stratigraphically higher in bed. *Fusulinella pria.*
	f13571	Bell County. Middle Pennsylvanian. Russell Ping colln. LC3-4 at same locality but stratigraphically higher within the 59-in. bed. *Fusulinella pria.*
	f13572	Bell County. Middle Pennsylvanian. Russell Ping collns. LC3-5, LC3-6 at same locality but stratigraphically higher in bed. *Fusulinella pria.*
	f13573	Bell County. Middle Pennsylvanian. Russell Ping colln. LC3-7 at same locality, but at top of limestone bed. *Fusulinella pria.*

REGISTER OF LOCALITIES AND COLLECTIONS—Continued

KENTUCKY–Continued

Locality	Collection	
	f13788 to f13794	Bell County. Middle Pennsylvanian. Kentucky coordinates 211,250 N., 2,640,550 E., Beverly Quadrangle, on strip bench west of Kentucky Highway 1201, about 2½ mi southwest of Beverly at head of Red Bird Creek. Samples through 30 ft in ascending order. C.L. Rice, collector, 1976. *Fusulinella pria.*
47	f13855 to f13866	Clay County. Middle Pennsylvanian. Stoney Fork Member from drill core at Bell Lookout Tower, 4,400 ft east and 900 ft south of northwest corner of Beverly 7½-min Quadrangle. BFT-1 (f13855) at bottom to BFT-11 (f13866) at top. Base of 48.5 ft of limestone at 1,899-ft altitude C.L. Rice, collector, 1977. *Fusulinella pria.*
48	f13585	Leslie County. Middle Pennsylvanian. Carter coordinates sec. 21, H-74, 1,100 ft from north line and 1,450 ft from west line, Cutshin 7½-min Quadrangle. Strip bench at altitude of 1,715 ft above sea level on divide between John Creek and Camp Creek of Middle Fork of Kentucky River, 1,800 ft northwest of hill marked 1,725 ft on topographic map. Locality 4-3. Top is 5 in. from top of limestone. C.L. Rice, collector, 1975. *Fusulinella pria.*
	f13586	Leslie County. Middle Pennsylvanian. Same area as f13585, but locality 4-4. Top is 7 in. from top of limestone. C.L. Rice, collector, 1975. *Millerella* sp.
	f13587	Leslie County. Middle Pennsylvanian. Same area as f13585, but locality 4-5. Top is 3 in. from top of limestone. C.L. Rice, collector, 1975. *Fusulinella* sp.
	f13588	Leslie County. Middle Pennsylvanian. Same area as f13585, but locality 4-6. About 2 in. from top of limestone. C.L. Rice, collector, 1975. *Fusulinella* sp.
	f13589	Leslie County. Middle Pennsylvanian. Same area as f13585, but locality 5-3. Middle of limestone. C.L. Rice, collector, 1975. *Fusulinella* sp.
	f13590	Leslie County. Middle Pennsylvanian. Same area as f13585, but locality 5-4. Top of limestone. C.L. Rice, collector, 1975. *Fusulinella pria.*
49	f14028	Clay County. Middle Pennsylvanian. 11,600 ft east and 9,650 ft north of northwest corner of Creekville 7½-min Quadrangle. Altitude 1,675 ft. Unnamed limestone at depth of about 96 ft and about 173 ft above Magoffin Member of Breathitt Formation. C.L. Rice, collector, 1978. *Fusulinella pria.*
	f14336	Clay County. Middle Pennsylvanian. Lat 37°03′12″ N., long 83°37′17″ W., northwest of Mudlick Church at head of Mudlick

REGISTER OF LOCALITIES AND COLLECTIONS—Continued

Locality	Collection	
		KENTUCKY–Continued
		Fork, Creekville 7½-min Quadrangle. G.W. Cumbee, collector, 1980. *Fusulinella pria.*
50	f13591 to f13596	Leslie County. Middle Pennsylvanian. On strip bench at altitude of 1,620+ ft on divide between Big Branch of Bull Creek and Cucumber Branch of Hell For Certain Creek, both of Middle Fork of Kentucky River, 2,400 ft east of hill marked 1,748 ft on Hayden West 7½-min Quadrangle. C.L. Rice colln. LC 7-1 (f13591) through LC 7-6 (f13596). June 1975. *Fusulinella pria.*
51	f13828	Perry County. Middle Pennsylvanian. Limestone from upper 2 ft of Stoney Fork Member of Breathitt Formation on strip bench just east of BM 1230 on Kentucky Highway 28, 2,300 ft west and 17,100 ft south of northeast corner of Buckhorn 7½-min Quadrangle. C.L. Rice colln. B1B. KG-76-7. *Fusulinella pria.*
52	f13597	Breathitt County. Middle Pennsylvanian. Carter coordinates sec. 11, L-74, 700 ft from north line and 50 ft from east line, Haddix 7½-min Quadrangle. Type locality of Stoney Fork Member of Breathitt Formation on divide between Lost Creek and Big Branch of North Fork of Kentucky River. Just north of gap through which road connecting the two streams passes, along old road that intersects road through gap, and just north of the second cemetery at altitude of about 1,210 ft above sea level. The Stoney Fork occurs just above Hindman coal bed but was found only as loose boulders and small rocks. C.L. Rice, colln. LC-8. *Fusulinella pria.*
53	f13767	Morgan County. Middle Pennsylvanian. From north-facing wall about 14 ft above Nickell coal bed at 1,070-ft altitude, 7,725 ft west and 2,750 ft south of northeast corner of Cannel City Quadrangle, lat 37°52′03″ N. long 83°01′35″W. Limestone containing some silicified fossils. Breathitt Formation. C.L. Rice, collector, June 1976. *Fusulinella pria.*
	f13985	Morgan County. Middle Pennsylvanian. Stoney Fork Member of Breathitt Formation. 6,300 ft east and 11,000 ft north of southeast corner of West Liberty 7½-min Quadrangle. C.L. Rice colln. KG-78-6. *Fusulinella pria.*
	f13986	Morgan County. Middle Pennsylvanian. Stoney Fork Member of Breathitt Formation. 5,300 ft west and 1,100 ft south of northeast corner of Cannel City 7½-min Quadrangle, about 20 ft up in high wall of strip mine. About 125 ft above Magoffin Member of Breathitt Formation. C.L. Rice colln. KG-78-6. *Fusulinella pria.*
	f14306	Morgan County. Middle Pennsylvanian. See f13767 for locality. Re-collection of C.L. Rice, 1976, locality. C.L. Rice, R.C. Douglass, and R. Margerum colln. 9-9-80-1. *Fusulinella pria.*
54	f14185	Lawrence County. Upper Pennsylvanian. Divide between Lost Creek and Big Branch of North Fork of Kentucky River. Just north of gap through which road connecting the streams passes and just north of second cemetery, at altitude 1,210 ft. Carter coordinates sec. 11, L-74, 700 ft from north line and 50 ft from east line, Haddix 7½-min Quadrangle. G. Merrill, collector, 1979. *Triticites ohioensis.*
	f14314	Lawrence County. Upper Pennsylvanian. Limestone about 6 in. thick, roadcut on west side of U.S. Highway 23 about ¾ mi south of bridge over Bear Creek. Approx. same as locality f14185 of G. Merrill. C.L. Rice, R.C. Douglass, and R. Margerum colln. 9-10-80. Re-collected by Rice. *Triticites ohioensis.*
	f14315	Lawrence County. Upper Pennsylvanian. Approx. same locality as f14314. C.L. Rice, R.C. Douglass, and R. Margerum colln. 9-10-80. *Triticites ohioensis.*
55	f13990	Carter County. Middle Pennsylvanian. Vanport Limestone as used by Phalen (1912). 7,500 ft west and 13,250 ft south of northeast corner of Willard 7½-min Quadrangle. C.L. Rice colln. KG-78-6. *Beedeina* sp.
56	f13991	Carter County. Upper Pennsylvanian. Carter coordinates sec. 20, U-79. 1,250 ft from south line and 1,950 ft from east line at altitude 950 ft, Webbville 7½-min Quadrangle. Cores from depth of 37.5–38 ft through Brush Creek Limestone Member. C.L. Rice colln. KG-78-7. *Triticites ohioensis.*
	f13992	Carter County. Upper Pennsylvanian. Same locality as f13991, but depth of 41.7 ft. C.L. Rice colln. KG-76-7. *Triticites ohioensis.*
	f13993	Carter County. Upper Pennsylvanian. Same locality as f13991, but depth of 33.7 ft in Brush Creek Limestone. C.L. Rice colln. KG-78-7. *Triticites ohioensis.*
57	f13584	Boyd County. Upper Pennsylvanian. Carter coordinates sec. 19, V-81, 3,000 ft from north line and 1,600 ft from east line, Rush 7½-min Quadrangle. From rock quarry 2,200 ft southwest of Long Branch School on southwest side of drainage running southeast into Long Branch and about 1,500 ft north of Clybur Cems [sic]. Brush Creek Limestone Member of Conemaugh Formation. C.L. Rice, collector, 1975. *Triticites ohioensis.*
58	f13576	Boyd County. Upper Pennsylvanian. "Fusulina" limestone, Boltsfork Quadrangle.

REGISTER OF LOCALITIES AND COLLECTIONS—Continued

Locality Collection

KENTUCKY–Continued

Left Fork of Friendship Creek, east of Mavity. J.W. Huddle, collector. *Triticites ohioensis.*

f14309 ____Boyd County. Upper Pennsylvanian. At 840-ft altitude in roadcut on west side of north/south road about 1½ mi east of Mavity, connecting Dog Fork with Friendship Creek, Boltsfork 7½-min Quadrangle. C.L. Rice, R.C. Douglass, and R. Margerum colln. 9–10–80–1. *Triticites ohoioensis.*

59 _____f13120 ____Boyd County. Upper Pennsylvanian. Lower Conemaugh Formation. Boltsfork 7½-min Quadrangle, along secondary road between Friendship Creek and Dog Fork, about ¼ mi south of gas-field boundary, unit 25 of measured section. E. Dobrovolny and T. Knous, collectors, 3–3–62. *Triticites ohioensis.*

f13122 ____Boyd County. Upper Pennsylvanian. "Fusulina" Limestone. Boltsfork Quadrangle. Roadcut on left fork of Friendship Creek, east of Mavity. E. Dobrovolny and T. Knous, collectors, 3–3–62. *Triticites ohioensis.*

f24987 ____Boyd County. Upper Pennsylvanian. 8,400 ft east of road junction 617 at Mavity, Boltsfork Quadrangle. D.E. Wolcott colln. BB–2, 1966. *Triticites ohioensis.*

60 _____f14311 ____Boyd County. Upper Pennsylvanian. North side of Dog Fork just east of powerline crossing and about 1½ mi east-northeast of Mavity. Boltsfork Quadrangle. C.L. Rice, R.C. Douglass, and R. Margerum colln. 9–10–80–3. *Triticites ohioensis.*

f14312 ____Boyd County. Upper Pennsylvanian. Brush Creek Limestone Member in abandoned quarry in ravine about 4/10 mi west of site of Long Branch School shown on Rush Quadrangle map. 6-in. limestone bed. Altitude approx. 760 ft. C.L. Rice, R.C. Douglass, and R. Margerum colln. 9–10–80–4. *Triticites ohioensis.*

f14313 ____Boyd County. Upper Pennsylvanian. Same locality as f14312, but about 10 ft lower in section. C.L. Rice, R.C. Douglass, and R. Margerum colln. 9–10–80–5. *Triticites ohioensis.*

61 _____f14308 ____Greenup County. Middle Pennsylvanian. Upper Allegheny Formation along powerline and just north of Ashland Coal Company office in Riverview area on bluff overlooking Ohio River. Southeast corner of Ironton Quadrangle. C.L. Rice, R.C. Douglass, and R. Margerum colln. 9–9–80–3. *Beedeina ashlandensis*

OHIO

62 _____f13787 ____Lawrence County. Middle Pennsylvanian.

REGISTER OF LOCALITIES AND COLLECTIONS—Continued

Locality Collection

OHIO–Continued

Upper Allegheny Formation, 3,200 ft west and 5,400 ft south of northeast corner Ashland 7½-min Quadrangle, Kentucky and Ohio. About 4 ft above and 20 ft northeast of U.S. Highway 52. Limestone 3½ ft thick. C.L. Rice, collector, 1976. *Beedeina ashlandensis.*

63 _____f14307 ____Lawrence County. Middle Pennsylvanian. Upper Allegheny Formation north side of southbound lanes of U.S. Highway 52, 0.5 mi east of 12th Street bridge over Ohio River. Re-collection of Rice f13787. Ashland Quadrangle. C.L. Rice, R.C. Douglass, and R. Margerum colln. 9–9–80–2. *Beedeina ashlandensis.*

64 _____f14316 ____Gallia County. Upper Pennsylvanian. Southeast of Patriot along Hannan Trace in NW¼NE¼ sec. 2, T. 4 N., R. 16 W., Rodney 7½-min Quadrangle. Shaley limestone at base of 18-in. limestone bed in small roadcut on northeast side of road. C.L. Rice, R.C. Douglass, and R. Margerum colln. 9–11–80–1. *Triticites ohioensis.*

f14317 ____Gallia County. Upper Pennsylvanian. Southeast of Patriot on Patriot-Cadmus Road near center SE¼ sec. 35, T. 5 N., R. 16 W., Rodney 7½-min Quadrangle. Just south of road in streambed. Nodular limestone below on 18–20-in. limestone. Cambridge Limestone Member of Smyth (1957), locality 7. C.L. Rice, R.C. Douglass, and R. Margerum colln. 9-11-80-2. *Triticites ohioensis.*

f14318 ____Gallia County. Upper Pennsylvanian. Near center sec. 35, T. 6 N., R. 16 W., Rodney 7½-min Quadrangle. Small outcrop along Garners Cora Road northwest of Garners Ford Bridge over Raccoon Creek. C.L. Rice, R.C. Douglass, and R. Margerum colln. 9–11–80–*3*. *Triticites ohioensis.*

65 _____f13997 ____Gallia County. Upper Pennsylvanian. Northeast bank of Hannan Trace Road, 750 ft east and 5,000 ft north of southwest corner of Rodney 7½-min Quadrangle. Near Smyth (1957) locality 7. Cambridge limestone and shale. C.L. Rice, collector, 1978. *Triticites ohioensis.*

66 _____f14004 ____Gallia County. Upper Pennsylvanian. 2,400 ft east and 5,050 ft south of northwest corner of Rodney 7½-min Quadrangle. 4-ft limestone on north side of Garners Cora Road at locality 15 of Smyth (1957). C.L. Rice, collector, 1978. Brush Creek Limestone Member in two parts, top and bottom of bed. *Triticites ohioensis.*

f14005 ____Gallia County. Upper Pennsylvanian. 4,300 ft south and 14,555 ft west of northeast corner of Vinton 7½-min Quadrangle at about 855-ft altitude. 1–2 ft of Ames

REGISTER OF LOCALITIES AND COLLECTIONS—Continued

Locality Collection

OHIO—Continued

Limestone Member in roadbank and road at Smyth (1957) locality 5. C.L. Rice, collector, 1978. *Triticites ricei.*

67 _____f14509 ____Hocking County. Middle Pennsylvanian. Boggs Limestone Member of Pottsville Formation from exposure on east side of U.S. Highway 93, approx. 0.4 mi north of Mt. Pleasant, SW¼ sec 34, Washington Township, New Plymouth 7½-min Quadrangle. R. Hoare colln. Hwa-1. *Profusulinella ohioensis, Fusulinella imprima.*

68 _____f14319 ____Athens County. Upper Pennsylvanian. East of Chauncey in NW¼SE¼ sec. 8, T. 10 N., R. 14 W., Jacksonville 7½-min Quadrangle. Ames? Limestone Member along tributary to Mill Creek along road to Brown Cemetery at about 770-ft altitude. Obscure outcrop in west bank of road. C.L. Rice, R.C. Douglass, and R. Margerum colln. 9-11-80-4. *Tricities skinneri, T. ohioensis*?

f14320 ____Athens County. Upper Pennsylvanian. Approx. same locality as f14319, but about 18 ft higher stratigraphically and possibly representing Gaysport Limestone Member. C.L. Rice, R.C. Douglass, and R. Margerum colln. 9-11-80-5. *Triticites skinneri.*

69 _____f9719 _____Perry County. Upper Pennsylvanian. Cambridge Limestone Member. Bearfield Township. West-central sec. 24. This locality was described by Condit (1912, p. 126-127). Pauline Smyth, collector, 9-8-53. *Triticites smythi, T. ohioensis.*

f9720 _____Perry County. Upper Pennsylvanian. Ames Limestone Member. Bearfield Township. West-central sec. 24. Locality was described by Condit (1912, p. 126-127). Ames Limestone Member here was source of type specimens for *Triticites skinneri* (Journal of Paleontology, v. 10, p. 683). Pauline Smyth, collector, 9-8-53. *Triticites skinneri.*

70 _____f13833 ____Muskingum County. Middle Pennsylvanian. Boggs Limestone Member of Pottsville Formation from creek bottom of Symmes Creek just above junction with North Branch, 13,050 ft east and 15,200 ft south of northwest corner of Adamsville 7½-min Quadrangle. C.L. Rice colln. RO-11. *Profusulinella*? sp.

71 _____f13817 to f13822 ____Muskingum County. Middle Pennsylvanian. North side of U.S. Highway I-70, underpass, 18,700 ft west and 19,000 ft south of northeast corner of Zanesville West Quadrangle. Vanport Limestone Member as identified by R.M. Delong. T-1 at base to T-24 at top of limestone. C.L. Rice colln. KG-76-8. *Beedeina carmani.*

72 _____f14146 ____Muskingum County. Upper Pennsylvanian. Ames Limestone Member. East side of Ohio Route 83, 0.3 mi south of junction with U.S. 40 in New Concord. R.C. Douglass, collector, 5-13-79. *Triticites skinneri.*

f14148 ____Muskingum County. Middle Pennsylvanian. Middle Mercer Limestone (local usage). At Cement Plant (Columbia) south of Zanesville off U.S. Route 22, about 3 mi southwest of junction with Ohio Route 93. R.C. Douglass, collector, 5-13-79. *Millerella* sp., *Fusulinella iowensis.*

73 _____f14000 ____Muskingum County. Middle Pennsylvanian. 2,400 ft south and 13,550 ft east of northwest corner of Dresden 7½-min Quadrangle. 1-2 in. of fossiliferous limestone "paves" entrance to small field and cemetery. Layer seems to grade into siltstone but may have been brought in for road ballast. All material seems to be similar. C.L. Rice colln. 2B. 1978. *Beedina* sp. aff. *B. leei.*

f14001 ____Muskingum County. Middle Pennsylvanian. 2,400 ft south and 13,550 ft east of northwest corner of Dresden 7½-min Quadrangle. Northwest of road and opposite south-trending driveway in massive fossiliferous silty limestone in place. C.L. Rice colln. 2A, about 12 ft northeast of colln. 2B. 1978. *Beedeina* sp.

f14002 ____Muskingum County. Middle Pennsylvanian. 1,350 ft south and 14,550 ft east of northwest corner of Dresden 7½-min Quadrangle on southeast side of road and about 25 ft above Vanport locality 40 of Smyth (1957). Nodular limestone, broken and slumped into thick whitish underclay. C.L. Rice, collector, 1978. *Beedeina* sp.

74 _____f13823 ____Muskingum County. Middle Pennsylvanian. W½ sec. 3, T. 2 N., R. 7 W., Dresden 7½-min Quadrangle. 12,400 ft north and 1,000 ft west of southeast corner of quadrangle. Lower Mercer Limestone Member at M.L. Thompson's locality on Blunt Run. T1 at base to T9 at top of limestone. C.L. Rice colln. RO-4-T1-T3. *Fusulinella*? sp.

f13824 ____Muskinghum County. Middle Pennsylvanian. Same locality as f13823. C.L. Rice colln. RO-4T4-T5. *Fusulinella iowensis.*

f13825 ____Muskingum County. Middle Pennsylvanian. Same locality as f13823. C.L. Rice colln. RO-4-T6-T8. *Fusulinella iowensis.*

f13826 ____Muskingum County. Middle Pennsylvanian. Same locality as f13823. C.L. Rice colln. RO-4-T9. *Fusulinella iowensis.*

f13829 ____Muskingum County. Middle Pennsylvanian. Boggs Limestone Member of Pottsville Formation in Blunt Run, 11,575 ft north and 300 ft west of southeast corner of Dresden 7½-min Quadrangle. C.L. Rice colln. RO-8-1

REGISTER OF LOCALITIES AND COLLECTIONS—Continued

Locality	Collection	
		OHIO—Continued
		at base through RO-8-11 at top. RO-8-3, RO-8-4. *Fusulinella imprima?*
	f13830	Muskingum County. Middle Pennsylvanian. Same locality as f13829. C.L. Rice colln. RO-8-5. *Fusulinella imprima?*
	f13831	Muskingum County. Middle Pennsylvanian. Same locality as f13829. C.L. Rice colln. RO-8-6-11. *Fusulinella* sp.
	f13832	Muskingum County. Middle Pennsylvanian. Upper Mercer Limestone Member in Blunt Run. 12,700 ft north and 1,100 ft west of southeast corner of Dresden 7½-min Quadrangle. C.L. Rice colln. RO-8-9-b. *Fusulinella iowensis.*
75	f9717	Muskingum County. Middle Pennsylvanian. Vanport Limestone Member. Hopewell Township. NE sec. 15 N. The place where Thompson collected the types for *Fusulinella carmani*. Pauline Smyth, collector, 9-8-53.
76	f13815	Muskingum County. Middle Pennsylvanian. Same as locality 73 of Smyth (1957), in center partial sec. 18, T. 1 N., R. 9 W., Gratiot Quadrangle, in center roadside ditch about 1 mi north of Mt. Sterling. 1,050 ft east of west line and 2,025 ft south of north line of sec. 18, Hopewell Township. Lower Mercer Limestone Member of Pottsville Formation. C.L. Rice, colln. KG-76-8. *Fusulinella iowensis.*
	f13816	Muskingum County. Middle Pennsylvanian. Same locality as f13815. C.L. Rice colln. KG-76-8. *Fusulinella iowensis.*
77	f14006	Licking County. Middle Pennsylvanian. 950 ft east and 1,300 ft south of northwest corner sec. 20, Hopewell Township, Gratiot 7½-min Quadrangle. C.L. Rice, collector, 1978. Vanport R-1 in float blocks of chert. *Beedeina* sp.
	f14007	Licking County. Middle Pennsylvanian. 1,800 ft west and 2,650 ft south of northeast corner sec. 11, Hopewell Township, Gratiot 7½-min Quadrangle. C.L. Rice, collector, 1978. Vanport R-2 in cherty limestone. *Beedeina* sp.
	f14147	Licking County. Middle Pennsylvanian. Lower Mercer Limestone Member. U.S. Route 40 about 3.1 mi west of Brownsville. 4-ft thick, exposed 10 ft above highway on north side of roadcut at roadside park. R.C. Douglass, collector, 5-13-79. *Fusulinella iowensis.*
78	f9718	Muskinghum County. Middle Pennsylvanian. Vanport Limestone Member. Cass Township on The Highlands, 1¾ mi north of Shannon. Pauline Smyth collector, 9-8-53. *Wedekindellina euthysepta, Beedeina* sp.

REGISTER OF LOCALITIES AND COLLECTIONS—Continued

Locality	Collection	
		OHIO—Continued
	f13847	Muskingum County. Middle Pennsylvanian. Vanport Limestone Member of Allegheny Formation at Smyth's (1957) locality 40, at 1,125 ft south and 15,250 ft east of northwest corner of Dresden 7½-min Quadrangle on north side of road. C.L. Rice colln. RO-13-*1*. *Wedekindellina* sp.
	f13848	Muskingum County. Middle Pennsylvanian. Same locality as f13847. C.L. Rice colln. RO-13-2 to RO-13-4. *Wedekindellina* sp.
	f13849	Muskingum County. Middle Pennsylvanian. Same locality as f13847. C.L. Rice colln. RO-13-5. *Wedekindellina euthysepta.*
	f13850	Muskingum County. Middle Pennsylvanian. Same locality as f13847. C.L. Rice colln. RO-13-6. *Wedekindellina* sp.
	f13851	Muskingum County. Middle Pennsylvanian. Same locality as f13847. C.L. Rice collns. RO-13-7, RO-13-8. *Wedekindellina* sp.
	f13852	Muskingum County. Middle Pennsylvanian. Same locality as f13847. C.L. Rice colln. RO-13-9. *Wedekindellina euthysepta, Beedeina* sp.
	f13853	Muskingum County. Middle Pennsylvanian. Same locality as f13847. C.L. Rice colln. RO-13-10. *Wedekindellina* sp.
	f13854	Muskingum County. Middle Pennsylvanian. Columbiana Limestone Member of Allegheny Formation about 22 ft above Vanport Limestone Member, 4,900 ft south and 11,200 ft east of northwest corner of Dresden 7½-min Quadrangle, on east side of road. C.L. Rice, colln. RO-12. *Wedekindellina* sp, *Beedeina* sp.
79	f13836	Coshocton County. Middle Pennsylvanian. Putnam Hill Limestone Member of Allegheny Formation at Smyth's (1957) locality 54, at 6,050 ft east and 21,600 ft north of southwest corner of Trinway 7½-min Quadrangle, on east side of road. C.L. Rice colln. RO-14, samples 1 at top to 11 at bottom. RO-14-1. *Beedeina leei.*
	f13837	Coshocton County. Middle Pennsylvanian. Same locality as f13836. C.L. Rice colln. RO-14-2. *Beedeina leei.*
	f13838	Coshocton County. Middle Pennsylvanian. Same locality as f13836. C.L. Rice colln. RO-14-3. *Beedeina leei.*
	f13839	Coshocton County. Middle Pennsylvanian. Same locality as f13836. C.L. Rice colln. RO-14-4. *Beedeina leei.*
	f13840	Coshocton County. Middle Pennsylvanian. Same locality as f13836. C.L. Rice colln. RO-14-5. *Beedeina leei.*
	f13841	Coshocton County. Middle Pennsylvanian. Same locality as f13836. C.L. Rice colln. RO-14-6. *Beedeina leei.*

REGISTER OF LOCALITIES AND COLLECTIONS—Continued

Locality	Collection	

OHIO—Continued

f13842 ____Coshocton County. Middle Pennsylvanian. Same locality as f13836. C.L. Rice colln. RO-14-7. *Beedeina leei.*

f13843 ____Coshocton County. Middle Pennsylvanian. Same locality as f13836. C.L. Rice colln. RO-14-8. *Beedeina leii.*

f13844 ____Coshocton County. Middle Pennsylvanian. Same locality as f13836. C.L. Rice colln. RO-14-9. *Beedeina leei.*

f13845 ____Coshocton County. Middle Pennsylvanian. Same locality as f13836. C.L. Rice colln. RO-14-10. *Beedeina leei.*

f13846 ____Coshocton County. Middle Pennsylvanian. Same locality as f13836. C.L. Rice colln. RO-14-11. *Beedeina leei.*

f9716 _____Coshocton County. Middle Pennsylvanian. Putnam Hill Limestone Member. Pike Township, east center sec. 20. This is measured section No. 1656 in files of Ohio Geol. Survey. Pauline Smyth, collector, 9-8-53. *Beedeina leei.*

80 _____f14149 ____Guernsey County. Upper Pennsylvanian. Bloomfield 7½-min Quadrangle. Cambridge Limestone Member. Small abandoned quarry approx. 1 mi northeast of New Concord in W½SE¼ sec. 25, Adams Township. R.C. Douglass, collector, 5-13-79. *Triticites ohioensis.*

81 _____f13827 ____Tuscarawas County. Middle Pennsylvanian. Center of partial sec. 3, T. 9 N., R. 4 W., Sugarcreek Quadrangle. 9,700 ft west and 15,000 ft south of northeast corner of quadrangle. Smyth (1957) locality 60 in Boggs Limestone. C.L. Rice colln. KG-76-8. *Fusulinella imprima*?

82 _____f9715 _____Tuscarawas County. Middle Pennsylvanian. Upper Mercer Limestone from Lawrence Township, ½ mi southeast of Zoar in railroad cut. Pauline Smyth, collector, 9-8-53. *Fusulinella iowensis.*

f14003 ____Tuscarawas County. Middle Pennsylvanian. 1 mi southwest of Mineral City on north side of Ohio Route 800 at locality 9 of Smyth (1957). Road and railroad may have been relocated. C.L. Rice colln. MC-1, about 10 ft above railroad bed and overlying coal bed. *Beedeina* sp.

83 _____f9714 _____Stark County. Middle Pennsylvanian. Lower Mercer Limestone Member from Bethlehem Township. SW¼W¼ sec. 16. Pauline Smyth, collector, 9-1-53. *Fusulinella iowensis.*

f13108 ____Stark County. Middle Pennsylvanian. Putnam Hill Limestone Member of Allegheny Formation. Pike Township, Dover 15-min Quadrangle. SW¼NE¼NE¼ sec. 27. L.G. Henbest, collector, 10-30-61. *Beedeina* sp.

f13109 ____Stark County. Middle Pennsylvanian. Vanport Limestone Member of Allegheny Formation. Dover 15-min Quadrangle. SW¼NE¼NE¼ sec. 27. L.G. Henbest, collector, 10-30-61. *Wedekindellina euthysepta, Beedeina henbesti.*

84 _____f13887 ____Columbiana County. Upper Pennsylvanian. NW¼NE¼ sec. 21, T. 13 N., R. 2 W., West Point 7-min. Quadrangle. Ames Limestone in roadbank on west side of Ohio Route 45 at crest of hill west of lookout tower. Locality 108 of Smyth (1957). R.C. Douglass, R. Ingavat, and C.H. Cheong colln. 5-26-4. *Triticites* sp. aff. *T. ricei.*

85 _____f13886 ____Mahoning County. Middle Pennsylvanian. Mouth of Turkey Broth Creek where it enters Berlin Lake at approx. locality 79 of Smyth (1957). Mercer Limestone Member. R.C. Douglass, R. Ingavat, and C.H. Cheong colln. 5-26-3. *Fusulinella iowensis.*

PENNSYLVANIA

86 _____f13884 ____Mercer County. Middle Pennsylvanian. Abandoned quarry on small road between Irishtown and Filer Corners, 5 mi east of Mercer, about 2 mi north of Irishtown. Vanport Limestone Member float. R.C. Douglass, R. Ingavat, and C.H. Cheong colln. 5-26-1. *Beedeina* sp.

f13885 ____Mercer County. Middle Pennsylvanian. Same general locality as f13884, but only 1 mi north of Irishtown in abandoned quarry. Vanport Limestone Member. R.C. Douglass, R. Ingavat, and C.H. Cheong colln. 5-26-2. *Beedeina* sp.

87 _____f9111 _____Armstrong County. Middle Pennsylvanian. 1 mi by road northeast of Mahoning. F. Swain, collector. *Beedeina* sp.

f13881 ____Armstrong County. Middle Pennsylvanian. About 1 mi by road (½ mi airline) northeast of Mahoning. 6 ft of limestone outcrop on west side of road. Mahoning Limestone of Rogers (1858). R.C. Douglass, R. Ingavat, and C.H. Cheong colln. 5-24-1. *Beedeina leei, B.* sp.

88 _____f13882 ____Allegheny County. Upper Pennsylvanian. Brilliant Cut on south bank of Allegheny River in Pittsburgh, just east of railroad bridge from Sharpsburg and south of highway. Ames Limestone. R. C. Douglass, R. Ingavat, and C.H. Cheong, with H.B. Rollins, colln. 5-25-1. *Triticites cullomensis.*

SYSTEMATIC DESCRIPTIONS

Profusulinella kentuckyensis Thompson and Riggs, 1959

Plate 1, figures 1–31

Profusulinella kentuckyensis Thompson and Riggs, *in* Thompson, Shaver, and Riggs, 1959, p. 776, 777, pl. 104, figs. 1–15.

Diagnosis. – Shell elongate fusiform, as much as 3.5 mm long and 1 mm wide at six volutions; nearly straight axis of coiling after first volution. Spirotheca thin, composed of protheca with irregularly developed outer tectorium, inner tectorium developed locally in parts of outer volutions.

Description. – Shell small, elongate fusiform attaining 3.5 mm in length and 1 mm in diameter; six volutions in the largest specimens. Initial chambers commonly forming a rounded to elliptical shell, axis of coiling at an angle of several to as much as 90° to the axis of the outer volutions. The axis is nearly straight in many specimens but is curved in others. Measurements for the newly illustrated specimens are given in table 1 and figure 6. The proloculus varies in outer diameter from near 0.05 to 0.11 mm in the specimens studied. It is quite round except for a slight flattening in the area of the apertural pore. The prolocular wall is thin and has an indistinct structure.

The spirotheca is composed of a tectum and diaphanotheca, with only a hint of fibrous structure in the outer volutions of some specimens. An outer tectorium is deposited irregularly. The deposits appear to be thicker along the lateral slopes, as stated by Thompson and Riggs (*in* Thompson, Shaver, and Riggs, 1959), but they are only apparent along the base of the septa and are, therefore, neither tectoria nor chomata. An inner tectorium is present only in small areas and in some specimens. In the holotype (figs. 1–3), some inner tectorium can be seen in parts of two volutions, and, in an equatorial section of a paratype (figs. 10–12), it can be seen in places in the two outer volutions. The minimal development of inner tectorium on this species suggests the first stage of advancement toward *Fusulinella*, but the species is more appropriately assigned to *Profusulinella*.

The septa are plane to irregularly fluted even across the central region in some specimens. The fourth and fifth volutions contain 19–20 septa per volution.

The tunnel extends one-third to one-half the volution height, is narrow in the inner volutions, and widens irregularly in the outer whorls. It tends to wander in most specimens. The chomata are low and asymmetrical, with a gentle slope toward the poles.

Discussion. – The description is based on the Thompson and Riggs specimens and on specimens collected from the type locality and other surface and well-core samples from western Kentucky. The specimens illustrated are from the core samples in addition to the type material. In outcrop and in the cores, this species is found at more than one horizon, but the differences between specimens from the several horizons are minor and not systematic. The specimens from the cores are shown in approximate stratigraphic order; those depicted in figures 28–31 occur below those depicted in figures 23–26, which, in turn, are below those shown in figures 21–22. The specimen depicted in figure 27 occurs below those shown in figures 19–20. Specimens shown in figures 13–18 are from the same general level as those shown in figures 19–20, which are from a different well. The outcrop samples are from limestone beds less than 10 ft apart. The core samples include one or more horizons through an interval of about 3 ft, followed by another set of horizons about 3 ft thick and 30–45 ft deeper in the wells. The surface samples correlate with the upper horizons in the wells; the lower horizons have not been recognized in the surface samples. The smallest specimens are dominant in the lower horizon, but some larger specimens were found even at the lowest horizon. The species is probably a late representative of the genus, as suggested by its elongate shape and the incipient development of the inner tectorium.

Distribution. – Surface samples containing this species include f13632 at locality 14 in Hancock County and f13630, f13631, f13900, f13901, and f13994 at locality 36 in Butler County, Ky. The core samples are from wells at locality 11 in Hancock County, 13 in Daviess County, 21 in Webster County, 31 in Christian County, 33 in Muhlenberg County, 34 and 37 in Butler County, and 38 in Ohio County, Ky. The samples containing *Profusulinella kentuckyensis* also have abundant specimens of *Millerella*. Thompson and Riggs (*in* Thompson, Shaver, and Riggs, 1959, p. 776) noted the wide variety of forms present, from partly evolute to involute. Because of the apparent complete gradation between the end members of *Millerella*, I do not believe that they should be separated into species, let alone genera, even though Thompson and Riggs (*in* Thompson, Shaver, and Riggs, 1959) assigned the more involute forms to *Paramillerella* sp.

Types. – Some of the originally illustrated specimens are here reillustrated. The additional specimens are hypotypes.

Profusulinella ohioensis Douglass n. sp.

Plate 2, figures 1–12

Diagnosis. – Shell minute, subrounded, attaining lengths near 0.7 mm, widths near 0.5 mm in four to five volutions. Coiling of first volution commonly at angle to later volutions. Spirotheca thin and composed of tectum, diaphanotheca, and outer tectorium. Septa nearly straight throughout.

TABLE 1.–*Measurements (in millimeters) for* Profusulinella kentuckyensis *Thompson and Riggs, 1959*

[Leaders (____), data not available or character absent]

Character	Measurements of fossils shown in plate 1, figures 13, 16, 18–22						
	13	16	18	19	20	21	22
Diameter of proloculus	0.10	0.11	0.08	0.09	0.10	0.08	0.07
Radius vector							
1	0.11	0.13	0.09	0.09	0.10	0.11	0.07
2	.17	.20	.15	.14	.15	.17	.12
3	.28	.29	.23	.20	.23	.22	.17
4	.37	.40	____	.30	.34	.32	.27
5	____	____	____	.41	____	____	____
Half length							
1	0.12	0.21	0.14	0.10	0.14	____	0.08
2	.25	.42	.30	.24	.24	____	.17
3	.49	.67	.41	.44	.44	____	.36
4	.76	.90	____	.77	.98	____	.54
5	____	____	____	1.08	____	____	____
Volution height							
1	0.03	0.05	0.03	0.03	0.025	0.03	0.02
2	.06	.06	.05	.05	.05	.04	.03
3	.10	.10	.08	.06	.07	.07	.05
4	.10	.10	____	.09	.11	.09	.09
5	____	____	____	.13	____	____	____
Wall thickness							
1	____	____	____	____	____	____	____
2	0.02	0.05	____	____	____	0.02	____
3	____	.04	.05	.04	____	.02	.025
4	____	____	____	____	____	.02	____
5	____	____	____	.05	____	____	____
Tunnel width (axials) or septal spacing							
1	0.03	____	0.02	0.03	____	0.025	0.03
2	.04	.07	.04	.06	____	.03	.04
3	.06	.11	.08	.11	____	.04	.05
4	.10	.17	____	.15	____	.06	____

Character	Measurements of fossils shown in plate 1, figures 23–30							
	23	24	25	26	27	28	29	30
Diameter of proloculus	0.09	0.09	0.07	0.05	0.09	0.06	0.07	0.11
Radius vector								
1	0.10	0.12	0.07	0.07	0.10	0.06	0.06	0.11
2	.16	.18	.12	.14	.15	.10	.10	.15
3	.23	.26	.17	.21	.23	.24	.15	.23
4	.33	____	.24	.28	.34	.34	.23	____
5	.46	____	____	____	.46	____	____	____
Half length								
1	0.14	____	0.09	0.10	0.16	____	0.09	0.11
2	.32	____	.21	.25	.33	____	.21	.21
3	.58	____	.38	.44	.54	____	.42	.44
4	1.14	____	.58	.73	.94	____	.56	____
5	1.52	____	____	____	1.22	____	____	____
Volution height								
1	0.03	0.05	0.02	0.03	0.03	0.04	0.02	0.02
2	.05	.06	.04	.06	.05	.06	.04	.04
3	.07	.08	.05	.08	.08	.07	.05	.07
4	.10	____	.07	.08	.11	.09	.07	____
5	.13	____	____	____	.12	____	____	____
Wall thickness								
1	____	____	____	____	____	____	____	
2	____	____	____	0.02	0.02	____	____	____
3	.03	____	____	____	____	.01	____	____
4	____	____	.04	____	____	.02	____	____
5	____	____	____	____	____	____	____	____
Tunnel width (axials) or septal spacing								
1	0.04	0.02	0.02	0.02	0.02	0.02	____	0.02
2	.09	.035	.04	.05	.06	.03	.02	.03
3	.14	____	.09	.07	.11	.04	.05	.06
4	____	____	____	.08	.18	.05	____	____

Description.–Measurements are presented in table 2 and on figure 7. Coiling of the first volution is commonly at a large angle to the outer volutions. The shape is quite rounded, expanding only a little faster in length than in width; maximum form ratios are near 1.3 in the outer volutions. Only four to five volutions are present. The observed prolocular diameters range from 0.06 to 0.12 mm, with a mean of 0.09 mm in six specimens.

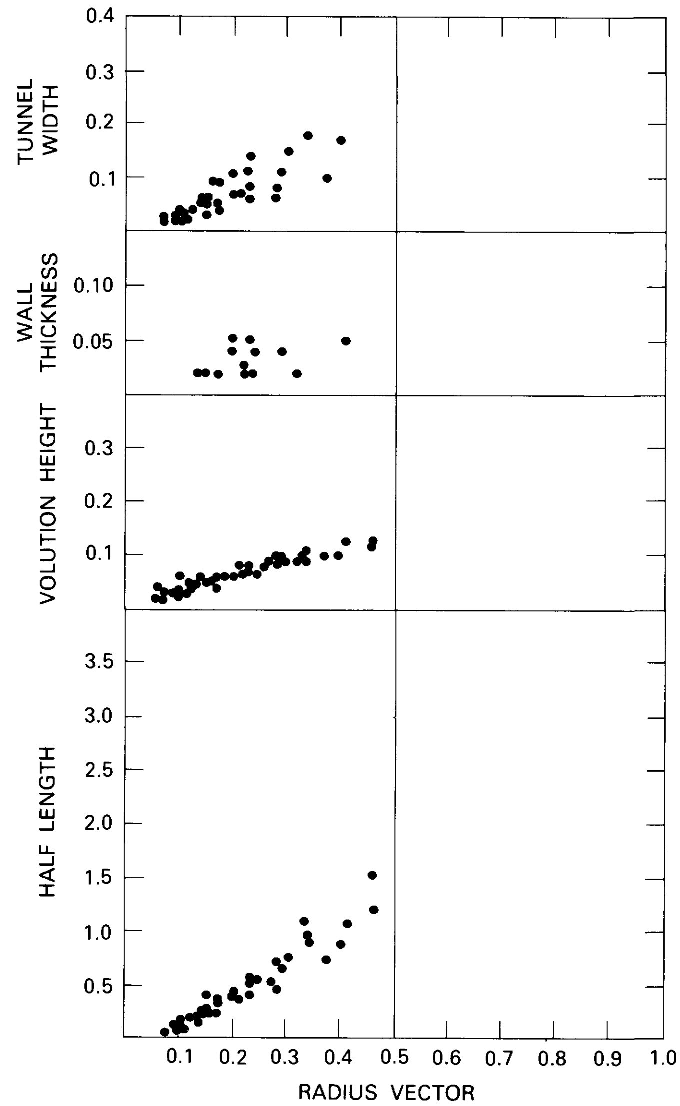


Figure 6.—Graphs for *Profusulinella kentuckyensis* Thompson and Riggs, 1959. All measurements are in millimeters, and the values for each attribute are plotted against the radius vector.

The spirotheca is thin and profusulinellid, having protheca and an outer tectorium but no inner tectorium. The septa are nearly plane but show slight and irregular fluting at the poles. They are irregularly spaced. The tunnel is fairly straight in the outer whorls and widens regularly. It is bordered by low broad chomata that are only well developed in the vicinity of the septa.

Comparison and remarks.—*Profusulinella ohioensis* is one of the smallest species of the genus. It resembles *P copiosa* Thompson, 1948, in general shape but is only about half its size at comparable volutions. *P. ohioensis* is about the same size as *P. fittsi* Thompson, 1935, but has a smaller form ratio and less-developed chomata.

Distribution.—*P. ohioensis* is known only from sample f14509 at locality 67 from Hocking County, Ohio, where it occurs in the Boggs Limestone Member of the Pottsville Formation. It is associated with the intermediate form *Fusulinella imprima* n. sp.

Specimens studied.—A large number of isolated specimens were studied, and seven were prepared as oriented thin sections for detailed study.

Designation of types.—The specimen illustrated on plate 2 as figures 9 and 10 is designated the holotype. The other illustrated specimens are paratypes.

Fusulinella imprima **Douglass n. sp.**

Plate 2, figures 13–24

Name derivation.—From the Latin *imprimis,* among the first.

Diagnosis.—Shell elongate fusiform attaining lengths near 4 mm and widths more than 1 mm in six volutions. Coiling regular, showing rapid increase in length with each volution. Spirotheca is profusulinellid through most of shell but develop inner tectorium in outermost volutions. Septa are irregularly fluted.

Description.—Measurements are presented in table 3 and on figure 8. Coiling is regular from the beginning, the shell expanding regularly in diameter and rapidly in axial length. The form ratio increases from near 2 in the inner volutions to more than 3 in the outer volutions.

TABLE 2.—*Measurements (in millimeters) for* Profusulinella ohioensis *Douglass n. sp.*

[Leaders (____), data not available or character absent]

Character	Measurements of fossils shown in plate 2, figures 1, 7, 10, 3–5					
	1	7	10	3	4	5
Diameter of proloculus	0.08	0.07	0.12	0.08	0.10	0.06
Radius vector						
1	0.09	0.06	0.08	0.12	0.13	0.07
2	.15	.15	.12	.18	.19	.10
3	.20	.20	.18	.26	.30	.16
4	.27	.25	.27	----	----	.24
5	----	----	----	----	----	----
6	----	----	----	----	----	----
Half length						
1	0.10	0.10	0.14	----	----	----
2	.16	.14	.18	----	----	----
3	.22	.21	.25	----	----	----
4	.32	.28	.36	----	----	----
5	----	.35	----	----	----	----
6	----	----	----	----	----	----
Volution height						
1	0.03	0.015	0.02	0.04	0.04	0.03
2	.06	.035	.03	.07	.07	.03
3	.05	.05	.06	.08	.10	.06
4	.07	.06	.08	----	----	.08
5	----	----	----	----	----	----
Wall thickness						
1	0.018	----	----	----	0.015	----
2	0.02	----	----	.02	.02	----
3	.035	.02	.03	.02	.03	----
4	----	.04	----	----	----	.02
5	----	----	----	----	----	----
Tunnel width (axials) or septal spacing						
1	0.03	0.02	0.04	0.02	0.03	0.01
2	.05	.04	.05	.025	.05	.03
3	.07	.04	.07	.035	.05	.03
4	----	.06	.10	----	----	.04

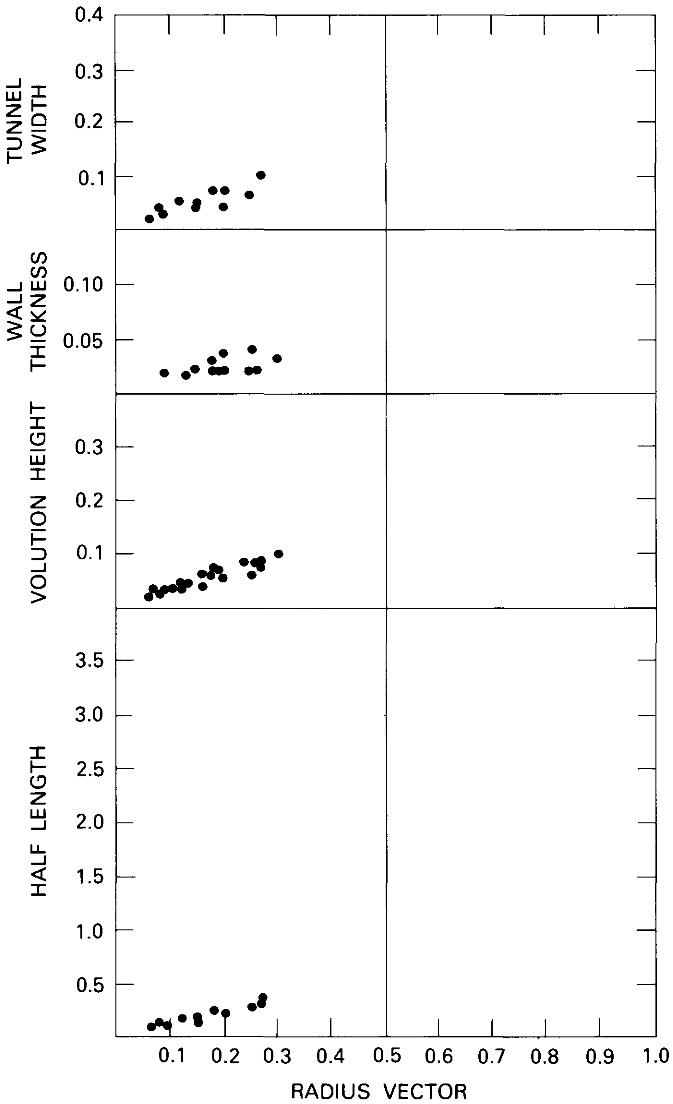


Figure 7.–Graphs for *Profusulinella ohioensis* Douglass n. sp. All measurements are in millimeters, and the values for each attribute are plotted against the radius vector.

The axis of coiling is nearly straight to irregularly curved. The maximum outer diameter of the proloculus ranges from 0.08 to 0.14 mm, averaging 0.11 in nine specimens.

The spirotheca is thin and is intermediate between profusulinellid and fusulinellid. Throughout most of the shell, the two layers of the protheca have only an outer tectorium, but in the outermost volutions, an inner tectorium is deposited. The inner tectorium is not continuous in some of the specimens, suggesting an early stage of development of the fusulinellid wall. The septa are slightly and irregularly fluted across the middle of the shell and irregularly fluted at the poles. Septal pores are common in some specimens. The septa are irregularly spaced and number 24 to 28 per volution in the outer whorls. The tunnel extends less than half the volution height. It widens gradually in the inner volutions and more rapidly in the outer whorls. Its path tends to be irregular in many of the specimens. The chomata are asymmetrical and tend to be high and broad. At and near the septa, they overhang the tunnel.

Comparison and remarks–*Fusulinella imprima* is one of the species intermediate between *Profusulinella* and *Fusulinella.* It is similar to *F. primotina* but differs in being larger, more elongate, and in having more chambers per volution. It is most similar to *F. pria* n. sp. but differs in being smaller, and in having fewer volutions, fewer chambers per volution, and a smaller proloculus. The assignment of this form to *Fusulinella* rather than *Profusulinella* is arbitrary and is based on this form's greater similarity to the several transitional forms assigned here, and previously assigned to *Fusulinella.* The wall structure is profusulinellid except in the outermost volutions, so immature specimens do not develop the fusulinellid stage.

Distribution–*F. imprima* is known from one sample in the Boggs Limestone Member of the Pottsville Formation at locality 67 in Hocking County, Ohio. Other samples of the Boggs Limestone Member yield specimens suggestive of this form, but all I saw were so poorly preserved that they did not justify description or illustration.

Specimens studied.–Twenty oriented sections were prepared from isolated specimens, many of which were abraded. Other sections of possibly conspecific forms from other samples of the Boggs Limestone Member were studied but not used in the description.

Designation of types.–The specimen illustrated on plate 2 as figures 19 and 20 is designated the holotype. The other illustrated specimens are paratypes.

Fusulinella primotina **Douglass n. sp.**

Plate 3, figures 1–23

Name derivation–From the Latin *primotinus,* early or first.

Diagnosis.–Shell irregularly fusiform, attaining lengths near 2.5 mm and widths near 1 mm in about six volutions. Coiling regular after the first volution, which may be at a large angle to subsequent volutions. Wall is profusulinellid through most of shell, but develops an inner tectorium in outermost volutions. Septa are straight across middle of shell and irregularly fluted at poles.

Description.–Measurements are presented in table 4 and on figure 9. The coiling, after the first volution, is regular, each volution tending to parallel the previous one, with little shape change throughout the ontogeny. The ratio of length to diameter (fig. 9) increases gradually from 1.3 in the inner volutions to approximately 2.8 at maturity. The axis of coiling is commonly irregular, so

TABLE 3.—*Measurements (in millimeters) for* Fusulinella imprima *Douglass n. sp.*

[Leaders (___), data not available or character absent]

Character	Measurements of fossils shown in plate 2, figures 15–17, 13, 18, 19, 21–23								
	15	16	17	13	18	19	21	22	23
Diameter of proloculus	0.13	0.13	0.13	0.10	0.09	0.08	0.11	0.11	0.14
Radius vector									
1	0.11	0.09	0.10	0.11	0.08	0.10	0.12	0.13	0.12
2	.18	.13	.14	.16	.14	.14	.18	.18	.18
3	.24	.22	.18	.24	.22	.20	.26	.26	.29
4	.33	.29	.25	.32	.31	.27	.39	.36	.41
5	.45	.41	.32	.45	.42	.40	.52	.51	.57
6	----	.57	.44	----	----	.56	----	.69	----
Half length									
1	0.22	0.21	----	----	0.17	0.18	0.27	0.16	0.24
2	.42	.37	----	----	.34	.32	.51	.31	.46
3	.55	.48	----	----	.65	.52	1.03	.71	.86
4	1.25	.96	----	----	1.00	1.02	1.68	1.15	1.14
5	----	1.38	----	----	1.66	1.51	2.09	1.59	1.80
6	----	----	----	----	----	2.11	----	2.08	2.35
Volution height									
1	0.04	0.03	0.02	0.02	0.02	0.03	0.03	0.04	0.02
2	.06	.08	.03	.04	.06	.04	.06	.05	.06
3	.06	.08	.035	.07	.07	.05	.08	.07	.10
4	.09	.11	.06	.09	.09	.07	.12	.10	.12
5	.12	.16	.08	.11	.11	.13	.14	.15	.16
6	----	----	.11	----	----	.16	----	.18	----
Wall thickness									
1	----	----	0.01	----	----	----	----	----	----
2	----	----	.015	.01	----	----	.02	----	.02
3	----	----	.02	.02	----	----	----	----	----
4	----	----	.02	.03	.04	----	.03	----	----
5	----	----	----	.04	----	----	----	----	----
6	----	----	----	----	----	----	----	----	----
Tunnel width (axials) or septal spacing									
1	0.04	0.04	0.02	0.02	0.03	0.03	0.06	0.03	0.04
2	.06	.06	.025	.03	.04	----	.08	.04	.08
3	.10	.09	.03	.05	.06	.07	.12	.06	.11
4	----	----	.04	.06	.07	.08	.18	.09	.18
5	----	----	.04	.09	.15	.11	----	.20	----
6	----	----	----	----	----	----	----	.21	----

many axial sections deviate from the axis toward one of the poles. The proloculus is variable in outer diameter from about 0.06 to 0.12 mm but is commonly close to 0.10 mm and tends to be round.

The spirotheca is of special interest in this form because it shows attributes intermediate between *Profusulinella* and *Fusulinella*. The inner volutions have a spirotheca composed of the protheca (tectum and diaphanotheca) and an outer tectorium. This structure is typical of *Profusulinella*. The outer volutions show some development of an inner tectorium. More inner tectorium is present in some specimens than in others, but the overall sample available shows that an inner tectorium is common in the last two volutions. The septa are nearly straight across the middle of the shell and are irregularly fluted at the poles. The septa are evenly spaced, and there are commonly 19–20 septa per volution from the fourth volution out. The tunnel is narrow and tends to be straight, but it is irregular in many of the specimens. It is generally less than half the chamber height. The chomata are generally low and broad but often appear higher or even overhanging where the section passes near a septum.

Comparison and remarks.—*F. primotina* is a form whose attributes are intermediate between those of *Profusulinella* and *Fusulinella*. Similar previously described species are *F. fugax* Thompson (1948), the specimens of *F. acuminata* Thompson (1936) that Thompson (1948) illustrated from Powwow Canyon, Tex., and *F. searighti* Thompson, 1953, from Missouri. *F. primotina* is also of the same general nature as *F. imprima* and *F. pria*, described herein from eastern Kentucky and from Ohio. *F. primotina* differs from *F. fugax*, which expands more rapidly in volution height and less rapidly in axial length and has a thicker spirotheca. Comparisons with *F. searighti* Thompson, 1953, are difficult because the seven specimens of that species illustrated show such variation. Several of the specimens have a straight axis of coiling and a regular fusiform shape, in contrast to the irregularities of *F. primotina*. The two adult axials illustrated by Thompson are both larger than any specimens of *F. primotina* having the same number of volutions. The specimens illustrated as *F. acuminata* by Thompson (1948, pl. 34) from Powwow Canyon, Tex., and from the Mud Springs Mountains, N. Mex., are similar in several attributes to *F. primotina*, but they are larger, have a larger proloculus, and have a straighter axis of coiling.

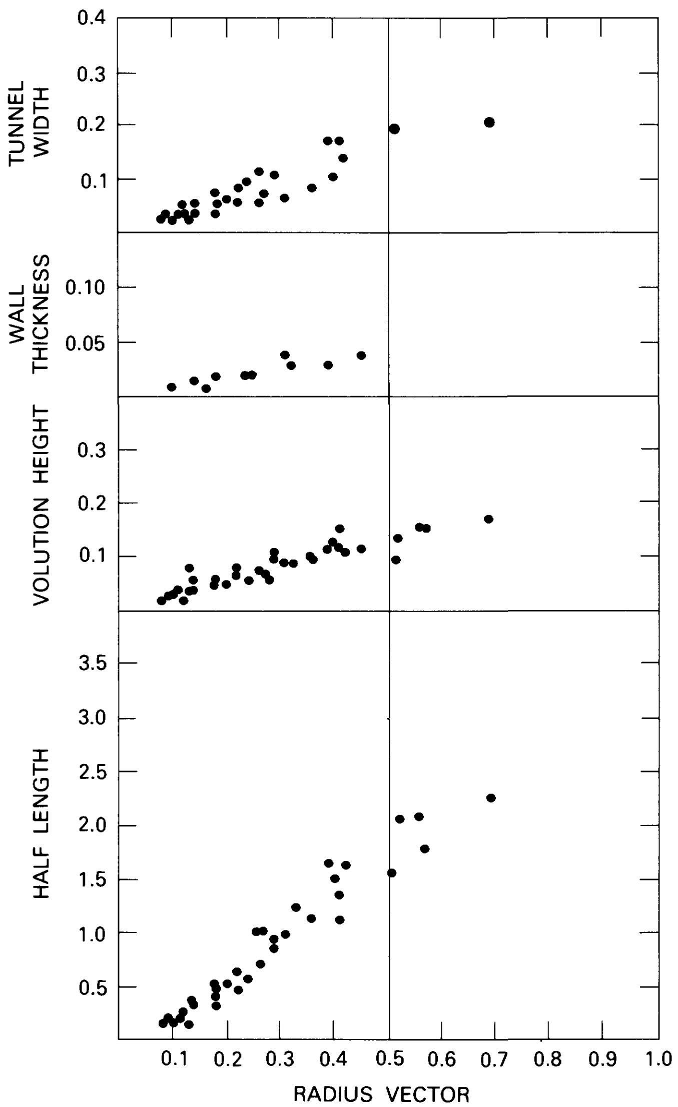


Figure 8.-Graphs for *Fusulinella imprima* Douglass n. sp. All measurements are in millimeters, and the values for each attribute are plotted against the radius vector.

Three species of this transitional group are described in this paper. *F. primotina* is the smallest and the most irregular in form and in axis and has the fewest chambers per volution.

Distribution. – *F. primotina* is known only from sample f13927 at locality 21 in Webster County, Ky. It was found in the core of Gil–31 at a depth of 471.5–471.7 ft, just 2 feet below the occurrence of *F. iowensis* in the core. No specimens of this species were found in the base of the Curlew Limestone Member at its type locality or in other beds below the *F. iowenis* horizon in the Eastern Interior Basin.

Specimens studied. – Thirty thin sections were prepared, each containing at least one oriented section of a specimen and one or more random sections of other specimens of this species. The types of the closely related species were studied for comparison.

Designation of types. – The specimen illustrated on plate 3 as figures 20 and 21 is designated the holotype. The other illustrated specimens are paratypes.

Fusulinella pria **Douglass n. sp.**

Plate 4, figures 1-18

Name derivation – From the Latin *prius*, earlier.

Diagnosis. – Shell elongate, fusiform, attaining lengths near 5.5 mm, widths near 1.5 mm in six volutions. Coiling is regular after first volution, with rapid increases in length but with irregular axis of coiling. Wall is composed of protheca and minimum epithecal deposits; inner tectorium restricted to parts of outer volutions. Septa are irregularly fluted throughout.

Description. – Measurements are presented in table 5 and on figure 10. Coiling of the first volution may be at an obtuse angle to the outer whorls. The shell expands regularly in diameter and rapidly in length, and form ratios expanding from near 1.5 in the inner volutions to more than 3 in the outer volutions (see fig. 10). The axis of coiling is irregularly curved, and the lateral slopes tend to be irregular. The proloculus ranges in maximum outer diameter from 0.09 mm to 0.22 mm with a mean of 0.15 mm in 16 specimens. The older specimens (lower stratigraphically) have the larger proloculi. The spirotheca is thin and of special interest because, in many parts of most specimens, it is composed solely of the protheca (tectum and diaphanotheca). A thin outer tectorium is present along parts of the wall, and an inner tectorium is deposited in the outer volutions. The daphanotheca has what Dunbar (*in* Thomas, 1931, p. 32) called fibrous structure, a structure resembling ultrafine keriotheca (fig. 11). The septa are irregularly fluted throughout the length of the shell and are irregularly spaced, about 32 per volution in the outer volutions. The tunnel is narrow and either straight or wandering in the equatorial area. It is bounded by low broad chomata that appear higher to overhanging in the vicinity of the septa.

Comparison and remarks. – *Fusulinella pria* is one of the forms that have attributes intermediate between those of *Profusulinella* and *Fusulinella.* The wall structure is more like that of *Profusulinella* than that of *Fusulinella* through most of its growth, but an inner tectorium is deposited in the outer volutions. *F. pria* is the largest of the three species of this group described in this paper. It has more volutions and larger dimensions, more chambers per volution, and more fluting across the middle of the shell. Some smaller specimens are similar in size to the largest specimens of *F. imprima* but still differ in septal count, septal fluting, and details of the wall.

TABLE 4.—*Measurements (in millimeters) for* Fusulinella primotina *Douglass n. sp.*

[Leaders (----), data not available or character absent]

Character	Measurements of fossils shown in plate 3, figures 1, 2, 4, 6–8, 10						
	1	2	4	6	7	8	10
Diameter of proloculus	0.09	0.10	0.11	0.10	0.11	0.08	0.10
Radius vector							
1	0.08	0.10	0.09	0.08	0.08	0.07	0.085
2	.10	.15	.15	.14	.12	.11	.12
3	.15	.20	.22	.22	.16	.15	.17
4	.21	.28	.31	.29	.28	.23	.25
5	.28	.39	.36	.38	.40	----	.34
Half length							
1	0.09	----	----	0.15	0.085	0.10	----
2	.15	----	----	.31	.23	.20	----
3	.27	----	----	.53	.44	.39	----
4	.42	----	----	.77	.69	.72	----
5	.78	----	----	1.20	.93	----	----
Volution height							
1	0.02	0.04	0.03	0.02	0.04	0.02	0.03
2	.05	.045	.06	.06	.045	.04	.03
3	.06	.05	.07	.06	.08	.04	.05
4	.09	.08	.075	.08	.10	.09	.08
5	.09	.10	.09	.10	.12	----	.09
Wall thickness							
1	0.015	----	0.01	----	----	0.02	----
2	.02	.01	.01	.03	.02	.02	----
3	.02	.01	.015	.03	.02	----	.02
4	.025	.02	.02	.05	----	----	.02
5	----	.03	----	----	----	----	.025
Tunnel width (axials) or septal spacing							
1	0.02	0.02	0.02	0.03	0.03	0.03	0.02
2	.04	.03	.03	.05	.05	.04	.03
3	.05	.03	.04	.08	.06	----	.03
4	.08	.04	.04	.12	.10	----	.04
5	----	.04	.05	----	.14	----	.05

Character	Measurements of fossils shown in plate 3, figures 12, 11, 14, 16, 19, 20, 22						
	12	11	14	16	19	20	22
Diameter of proloculus	0.12	0.06	0.07	0.07	0.09	0.085	0.11
Radius vector							
1	0.10	0.08	0.08	0.08	0.09	0.11	0.13
2	.15	.15	.13	.09	.15	.16	.21
3	.21	.26	.19	.13	.22	.23	.29
4	.31	.39	.26	.20	.30	.32	.38
5	----	.51	----	.26	----	----	.47
Half length							
1	----	0.11	0.13	0.14	0.11	0.17	0.29
2	----	.24	.23	.29	.24	.35	.48
3	----	.49	.41	.49	.48	.56	.74
4	----	.75	.59	.74	.80	.76	1.01
5	----	1.09	----	.87	----	----	1.35
Volution height							
1	0.03	0.03	0.02	0.03	0.02	0.03	0.04
2	.05	.05	.05	.05	.05	.05	.07
3	.065	.06	.06	.06	.07	.08	.09
4	.09	.07	.07	.07	.08	.09	.09
5	----	.11	----	.11	----	----	.09
6	----	.13	----	----	----	----	----
Wall thickness							
1	0.005	----	----	----	----	0.03	0.02
2	.01	----	----	.01	----	.03	.03
3	.02	.025	.03	----	.03	.05	----
4	.03	.03	.04	----	----	----	.03
5	----	.045	----	.02	----	----	----
Tunnel width (axials) or septal spacing							
1	0.02	0.025	0.02	0.03	0.03	----	0.03
2	.03	.04	.03	.03	.05	.06	.06
3	.04	.06	.05	----	.07	.12	.12
4	.04	.10	.08	.13	----	----	.15
5	----	.12	----	----	----	----	----

Distribution.—*F. pria* is common in the Stoney Fork Member of the Breathitt Formation in eastern Kentucky from Bell County in the south to Morgan County and is present in collections from localities 45 through 53.

Specimens studied.—The description is based on specimens from the samples at locality 46 in Bell Coun-

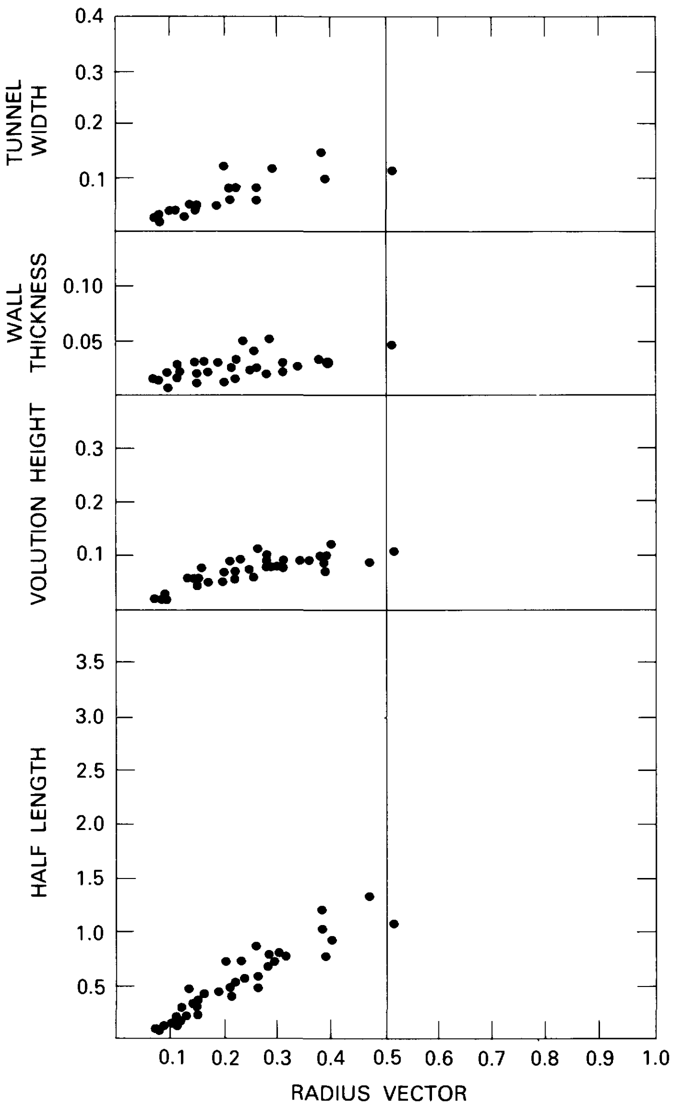


Figure 9.–Graphs for *Fusulinella primotina* Douglass n. sp. All measurements are in millimeters, and the values for each attribute are plotted against the radius vector.

ty, supplemented by information from 32 other samples found in six counties. 115 thin sections were prepared, and other material was studied in etched slices.

Designation of types.–The specimen illustrated as figures 14 and 16 is designated the holotype, and the other illustrated specimens are paratypes.

Fusulinella stouti Thompson, 1936

Plate 5, figures 1-26

Fusulinella iowensis var. *stouti* Thompson, 1936, p. 676-677, pl. 90, figs. 5-11; Dunbar and Henbest, 1942, p. 95, pl. 3, figs. 7-9; Smyth, 1957, p. 263, pl. 1, figs. 8-9.

Fusulinella stouti Thompson and Riggs *in* Thompson, Shaver, and Riggs, 1959, p. 780, pl. 105, figs. 12-24.

Diagnosis.–Shell variable from fusiform to elongate fusiform, attaining a length of as much as 3.7 mm and a width of as much as 1.5 mm in eight to nine volutions. Proloculus variable in outer diameter. Spirotheca thin, composed of protheca and inner and outer tectoria. Septa numerous and irregularly fluted.

Description.–Measurements for the specimens here illustrated are given in table 6 and on figure 11. Thompson's original description and illustrations indicate a variable species with considerable latitude in inflation, septal fluting, and development of chomata. The suite of specimens from the Curlew Limestone Member of the Tradewater Formation in western Kentucky shows a similar wide range of variability. The shell is generally fusiform to elongate fusiform, with lateral slopes that range from convex through straight to slightly concave. Lengths to 3.7 mm and widths to 1.5 mm are attained in eight to nine volutions. Form ratios range from 1.5 to near 2.5 in mature specimens (fig. 11). The early volutions commonly have low ratios. The proloculus ranges in outer diameter from 0.06 to 0.17 mm, averaging 0.10 mm in 26 specimens.

The spirotheca is thin but includes the protheca and varying amounts of epitheca. Many specimens have an outer tectorium about equal in thickness to the rest of the wall, whereas others have a relatively thin outer tectorium. An inner tectorium is developed throughout the outer four to five volutions. The septa are irregularly fluted and, contrary to the original description, show fluting even in the middle of the shell of some specimens. The septa are numerous and are closely, but often irregularly, spaced.

The tunnel is relatively narrow and though fairly straight in some specimens, tends to wander in the equatorial area. It is generally less than half the chamber height. The chomata are high and broad and are overhanging in the vicinity of the septa.

Comparison and remarks.–*F. stouti,* despite its variability, is a relatively distinctive form. The dense look of the interior whorls caused by the nearly straight septa and the extended chomata is characteristic of only a few species. *F. iowensis* is similar but is more inflated, producing a smaller form ratio. The specimens from the Curlew Limestone Member illustrated here and in Thompson, Shaver, and Riggs (1959) show a little more of the inner density than the Ohio specimens illustrated by Thompson (1936).

Distribution.–*F. stouti* was first described from beds referred to the Boggs Limestone and Mercer Limestone Members of the Pottsville Formation in Ohio. It was subsequently described from the Seville Limestone Member of the Spoon Formation in Illinois and from the Curlew Limestone Member of the Tradewater Formation in western Kentucky. All the present illustrations are from the type locality of the Curlew Limestone

TABLE 5.—*Measurements (in millimeters) for* Fusulinella pria *Douglass n. sp.*

[Leaders (___), data not available or character absent]

Character	Measurements of fossils shown in plate 4, figures 1-8							
	1	2	3	4	5	6	7	8
Diameter of proloculus	0.09	0.09	0.11	0.12	0.09	0.13	0.14	0.16
Radius vector								
1	0.07	0.06	0.09	0.10	0.10	0.12	0.22	0.14
2	.10	.11	.16	.15	.15	.18	.30	.20
3	.15	.16	.23	.21	.26	.26	.41	.30
4	.22	.23	.32	.31	.35	.35	.51	.41
5	.32	.30	.40	.39	.47	----	.63	.52
6	.41	.42	.55	.52	----	----	----	.69
7	.52	----	----	----	----	----	----	.86
Half length								
1	0.07	----	0.12	0.16	0.10	----	0.24	----
2	.12	----	.26	.30	.22	----	.46	----
3	.26	----	.50	.50	.36	----	.83	----
4	.48	----	.71	.78	.64	----	1.17	----
5	.76	----	.96	1.25	1.03	----	1.54	----
6	1.20	----	1.54	1.48	1.32	----	2.07	----
7	1.58	----	----	----	----	----	2.58	----
Volution height								
1	0.02	0.02	0.02	0.02	0.03	0.02	0.04	0.03
2	.03	.05	.06	.04	.04	.05	.07	.05
3	.05	.045	.08	.06	.05	.08	.08	.09
4	.07	.07	.09	.10	.07	.10	.10	.11
5	.10	.08	.10	.08	.09	----	.11	.12
6	.10	.11	.12	.14	.12	----	.12	.16
7	.12	----	----	----	----	----	----	.17
Wall thickness								
1	0.01	----	----	----	0.01	----	----	0.01
2	----	----	.02	----	----	.02	----	.01
3	.02	.02	.02	.02	.02	----	.03	----
4	----	.03	----	----	----	.02	----	.03
5	.04	.03	----	.03	----	----	.035	.04
6	----	----	----	.04	----	----	----	.05
Tunnel width (axials) or septal spacing								
1	----	0.02	0.01	0.02	----	0.02	0.04	0.025
2	0.02	.02	.02	.03	.02	.03	.07	.04
3	.03	.03	.05	.06	.05	.03	.10	.05
4	.06	.05	.09	----	.08	.04	.18	.05
5	----	.06	.11	.13	.10	----	.23	.06
6	.14	----	----	----	.19	----	----	.06

Member in Union County, Ky. Other specimens were recognized in other surface and subsurface samples from this horizon in western Kentucky.

Specimens studied.—Specimens originally described by Thompson (1936) were studied, in addition to specimens from the localities described by Smyth (1957). Most of the specimens studied were from locality 17 in Union County; supplemental specimens were from locality 20 in Crittenden County and locality 32 in Christian County, Ky.

Designation of types.—The specimen illustrated by Thompson (1936) as figure 10 on his plate 90 is designated the lectotype.

Fusulinella iowensis Thompson, 1934

Plate 6, figures 1-16; plate 15, figures 14-26

Fusulinella iowensis Thompson, 1934, p. 296–297, pl. 20 figs. 28–30; Thompson, 1936, p. 675–676, pl. 90, figs. 12–16; Dunbar and Henbest, 1942, p. 93–95, pl. 3, figs. 10–25; Thompson, 1948, pl. 26, fig. 12, designated the holotype (lectotype); Smyth, 1957, p. 262–263, pl. 1, figs. 5–7, 10, 11; Thompson and Riggs, *in* Thompson, Shaver, and Riggs 1959, p. 777–780, pl. 105, figs. 1–11

Diagnosis.—Shell short and obese, as much as 3.5 mm in length and 2.5 mm in width in 10 volutions; form ratio near 1.4 in mature specimens. Proloculus ranges from 0.05 to 0.13 mm in outer diameter. Wall consists of protheca and commonly thick epithecal deposits. Tunnel straight to irregular with high broad chomata.

Descriptions.—Measurements for the specimens illustrated on plates 6 and 15 are given in table 7 and on figure 12, except for specimens 1–7 on plate 6, for which data were tabulated by Thompson and Riggs (*in* Thompson, Shaver, and Riggs, 1959, p. 778). The shell is small and highly inflated fusiform with nearly straight to concave or convex lateral slopes and broadly rounded to pointed poles. The first whorl may be at a large angle to the rest of the specimen, as illustrated by Dunbar and Henbest (1942, pl. 3, figs. 15, 25) and by Thompson and Riggs (*in* Thompson, Shaver, and Riggs, 1959), reproduced here on plate 6, figure 1. Subsequent growth is quite regular, the shell expanding rapidly in both length and width, maintaining a small form ratio (fig. 12). The proloculus ranges from about 0.04 to near 0.13 mm in outer diameter. The specimens having the largest

TABLE 5.—*Measurements (in millimeters) for* Fusulinella pria *Douglass n. sp.*—Continued

Character	Measurements of fossils shown in plate 4, figures 9, 10, 12–15, 17, 18							
	9	10	12	13	14	15	17	18
Diameter of proloculus	0.16	0.14	0.19	0.22	0.20	0.12	0.21	0.15
Radius vector								
1	0.14	0.14	0.14	0.20	0.16	0.15	0.20	0.18
2	.20	.22	.21	.28	.22	.22	.28	.25
3	.30	.32	.29	.40	.33	.36	.37	.34
4	.41	.43	.40	.54	.46	.48	.50	.45
5	.52	.55	.54	.73	.60	61	.65	.60
6	.69	----	----	.89	.75	.75	----	----
7	.86	----	----	----	----	----	----	----
Half length								
1	----	----	0.31	0.30	0.23	----	0.37	----
2	----	----	.48	.44	.43	----	.58	----
3	----	----	.81	.97	.86	----	1.02	----
4	----	----	1.34	1.20	1.32	----	1.46	----
5	----	----	2.00	2.38	2.00	----	1.87	----
6	----	----	----	2.83	2.55	----	----	----
7	----	----	----	----	----	----	----	----
Volution height								
1	0.03	0.03	0.04	0.05	0.05	0.06	0.07	0.04
2	.05	.08	.07	.08	.07	.07	.08	.06
3	.09	.10	.08	.12	.10	.13	.09	.09
4	.11	.11	.10	.14	.12	.12	.12	.11
5	.12	.13	.14	.18	.15	.14	.15	.15
6	.16	----	----	.17	.15	.14	----	----
7	.17	----	----	----	----	----	----	----
Wall thickness								
1	0.01	0.01	----	----	----	0.02	----	0.01
2	----	.01	.03	.03	----	----	.03	.01
3	----	.02	----	----	.03	----	.04	.02
4	----	.05	.04	----	.04	.03	.06	.03
5	.04	.03	----	----	.03	.04	----	.04
6	----	----	----	----	.04	----	----	----
Tunnel width (axials) or septal spacing								
1	0.025	0.02	0.03	0.04	0.05	0.02	0.04	0.02
2	.04	.03	.05	.09	.06	.03	.06	.03
3	.05	.05	.09	.11	.08	.05	.11	.04
4	.05	.05	.14	----	.16	.07	.20	.05
5	.06	----	.21	.28	.24	.08	.25	.07
6	.06	----	----	----	----	----	----	----

proloculi are from Illinois and Kentucky, but the specimens from Ohio also have larger proloculi than those illustrated from Iowa. The spirotheca is composed of protheca and, in many specimens, an unusually thick outer tectorium. The inner tectorium is present throughout most of the shell. The septa are numerous and closely but irregularly spaced. They are irregularly fluted throughout the shell in the outer volution and toward the poles in the inner volutions. The tunnel is narrow, and, in most specimens, it wanders irregularly in the equatorial area. It is commonly about half the chamber height. The chomata are high and broad, decreasing in breadth in the outermost volutions.

Comparisons and remarks.—The inflated form with tight coiling and the broad chomata combined with nearly straight septa in the inner volutions make *Fusulinella iowensis* easy to recognize and distinctive among the fusulinellas.

Distribution.—The original specimens of this species were described from a limestone 20 ft above rocks of Mississippian age and about 90 ft below the White Breast coal bed in Jefferson County, Iowa. The species subsequently has been described from the Mercer Limestone Member of the Pottsville Formation in Ohio, the Seville Limestone Member of the Spoon Formation in Illinois, and the Curlew Limestone Member of the Tradewater Formation in Kentucky. No representatives have been found in eastern Kentucky.

Specimens studied.—The types from Iowa and hypotypes from Illinois, Ohio, and Kentucky were studied, in addition to specimens from localities 17 in Union County, 21 in Webster County, and 31 and 32 in Christian County, Ky., and from localities 82 in Tuscarawas County, 74 and 76 in Muskingum County, and 85 in Mahoning County, Ohio.

***Fusulinella* sp.**

Plate 6, figures 17–22

Description.—Several specimens in collection f13635 at locality 32 and in collection f13741B at locality 31, both in Christian County, Ky., are quite distinct from the *Fusulinella iowensis* Thompson, with which they are associated. They are much more elongate and have low

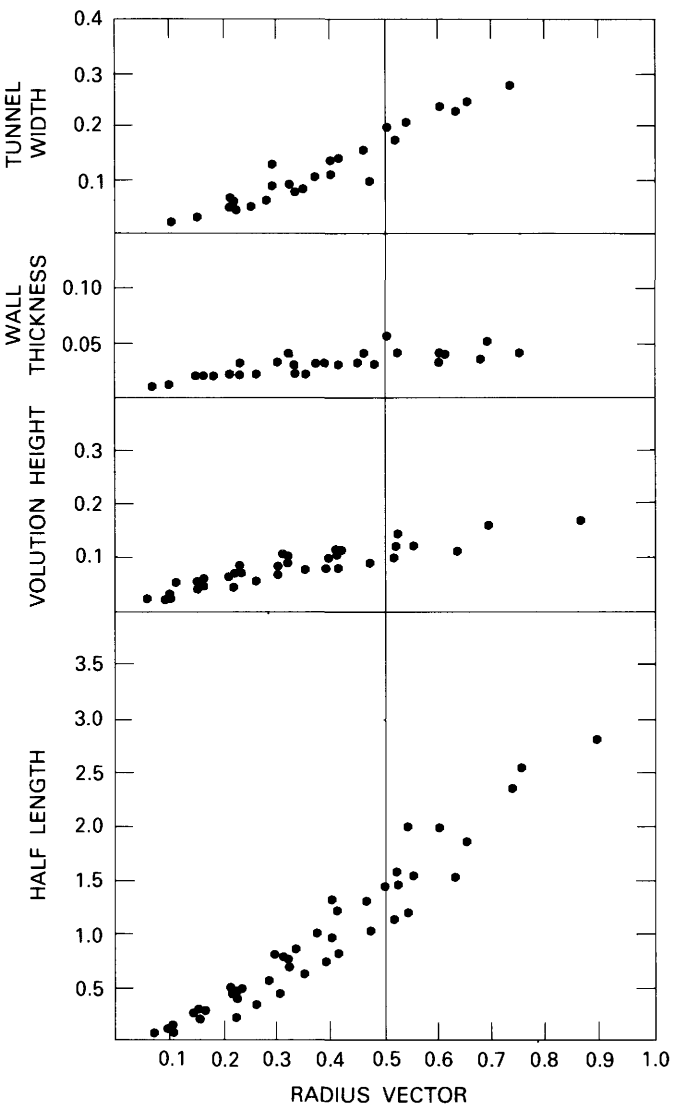


Figure 10.–Graphs for *Fusulinella pria* Douglass n. sp. All measurements are in millimeters, and the values for each attribute are plotted against the radius vector.

narrow chomata. They bear some resemblance to *F. acuminata* Thompson, 1936, but have a smaller proloculus and are more tightly coiled. Similar forms were not found associated with *F. iowensis* in the other samples. Measurements are presented in table 8 and figure 13.

Wedekindellina euthysepta (Henbest), 1928

Plate 7, figures 1-42; plate 16, figures 32-35

Fusulinella euthusepta Henbest, 1928, p. 80-81, pl. 8, fig. 6-8, pl. 9, figs. 1, 2.
Wedekindella euthysepta Dunbar and Henbest, 1930, p. 357-364.
Wedekindia euthysepta Dunbar and Henbest, 1931, p. 458.
Wedekindellina euthysepta Dunbar and Henbest, 1933, p. 134, key pl. 10, figs. 13-15; Thompson, 1934, p. 282-285, pl. 20, figs. 1, 2, 7, 9, 12, 13, 17, 22, 24-27; Dunbar and Henbest, 1942, p. 98-100, pl. 8, figs. 1-23, pl. 9, fig. 1-4; Smyth, 1957, p. 269-270, pl. 2, figs. 15, 16, 20; St. Jean, 1957, p. 50-53, pl. 5, figs. 18-32.
Wedekindellina dunbari Thompson, 1934, p. 285-287, pl. 20, figs. 3, 6, 15, 16, 20, 21.
Wedekindellina uniformis Thompson, 1934, p. 289, 290, pl. 20, fig. 5.
Wedekindellina elfina Thompson, 1934, p. 287-289, pl. 20, figs. 8, 10, 11.

Diagnosis. – Small slender shell with straight to slightly convex or concave lateral slopes and nearly straight septa. Proloculus small and coiling tight. Narrow irregular tunnel and broad chomata. Wall of thin protheca, inner tectorium, and variable amounts of outer tectorium.

Description. – This form has been described several times, commonly with more stringent limitations than those given in the following description. Measurements for this species are provided in table 9 and on figure 14. The samples studied and the previously described specimens show a large size and shape variation. Some of the differences reflect growth stage, but some variability also exists in rate of expansion in both the equatorial and axial directions. The shapes tend to be elongate fusiform with straight to slightly curved lateral slopes and pointed poles. Rare specimens start with an endothyrid juvenarium, but most coil regularly and maintain a nearly uniform chamber height well out onto the lateral slopes.

The proloculus varies widely in maximum outer diameter but rarely exceeds 0.10 mm; it had a mean of 0.07 mm in 40 specimens. Only rare examples of microspheric proloculi have been found. One such specimen illustrated by Thompson (1934, pl. 20, fig. 5) was assigned to a new species, but, because it is associated with abundant *Wedekindellina euthysepta* and does not differ in other ways, I do not consider it distinct.

The spirotheca is generally quite thin and composed of a protheca and varying amounts of tectoria. An inner tectorium is common, and an outer tectorium along the flanks – especially at the base of the septa – develops an axial filling. Dunbar and Henbest (1942, p. 98) discussed the porosity in the protheca that is evident in some specimens. Many of the specimens show the fine porosity especially well in equatorial section.

The septa are essentially straight in most specimens but show some weak fluting – especially in the poles. The septa are closely and fairly regularly spaced in the inner volutions; more irregularity appears in the outer volutions. The tunnel is narrow and tends to wander in the equatorial area. It commonly extends more than half the chamber height. The chomata are low and broad, often appearing to extend laterally where epitheca are deposited along the base of the septa, forming axial filling.

TABLE 6.–*Measurements (in millimeters) for* Fusulinella stouti *Thompson, 1936*

[Leaders (____), data not available or character absent]

Character	Measurements of fossils shown in plate 5, figures 1–9								
	1	2	3	4	5	6	7	8	9
Diameter of proloculus	0.08	0.09	0.12	0.09	0.14	0.08	0.09	0.10	0.07
Radius vector									
1	0.07	0.11	0.11	0.09	0.11	0.08	0.10	0.075	0.07
2	.13	.15	.16	.15	.16	.11	.15	.12	.11
3	.20	.21	.24	.21	.26	.19	.22	.17	.17
4	.30	.29	.34	.31	.36	.25	.34	.26	.26
5	.45	.39	.45	.39	.48	.35	.45	.38	.36
6	.59	.50	.60	.56	.59	.48	.58	.53	.50
7	.75	.64	.74	.69	.75	.62	.72	.71	.66
8	____	.80	____	____	.89	.79	.90	____	.83
Half length									
1	0.10	0.12	____	0.11	0.16	____	____	0.10	0.09
2	.23	.23	____	.24	.25	____	____	.17	.13
3	.41	.34	____	.39	.41	____	____	.36	.27
4	.58	.51	____	.58	.68	____	____	.55	.41
5	.77	.79	____	.99	.86	____	____	.79	.55
6	1.00	1.02	____	1.39	1.05	____	____	1.12	.79
7	1.34	1.15	____	1.60	1.34	____	____	1.43	1.01
8	____	1.31	____	____	1.58	____	____	____	1.27
Volution height									
1	0.03	0.04	0.04	0.02	0.03	0.03	0.03	0.02	0.03
2	.05	.04	.05	.03	.05	.03	.05	.05	.04
3	.07	.06	.08	.04	.09	.07	.08	.05	.06
4	.11	.07	.10	.10	.11	.03	.11	.02	.08
5	.16	.11	.11	.08	.12	.10	.11	.125	.11
6	.15	.11	.15	.17	.12	.13	.13	.145	.14
7	.16	.14	.15	.16	.16	.16	.14	.185	.16
8	____	.16	____	____	.18	.16	.18	____	.17
Wall thickness									
1	____	____	____	0.01	____	____	____	____	____
2	____	____	____	.01	____	____	.02	____	____
3	____	.01	.02	.01	____	.01	.02	.012	____
4	____	____	.025	.02	____	.015	.03	.02	____
5	____	____	.025	.03	____	.02	.03	____	.025
6	____	____	.045	____	____	.035	.05	____	____
7	____	____	____	____	____	____	____	____	____
8	____	____	____	____	____	.05	____	____	____
Tunnel width (axials) or septal spacing									
1	0.02	____	0.02	____	0.03	____	____	____	____
2	.03	____	.03	.02	.03	.02	.02	.02	.015
3	.03	.02	.04	.02	____	.025	.03	.035	.02
4	.06	.04	.05	.04	.05	.04	.03	.035	.03
5	.07	.06	.06	.06	.07	.04	.03	.06	.05
6	____	.08	.05	.14	____	.05	.03	.12	.07
7	____	.12	____	____	____	.07	.05	.15	.11
8	____	____	____	____	____	.07	____	____	.20

Comparison and remarks.–*W. euthysepta* is quite variable in size and shape within any one sample. Some specimens have been assigned to other species on the basis of minor differences in size, shape, or wall thickness. Most of the size differences are based on maturity, the smaller specimens having fewer volutions. Large and small forms are present in most samples. Dunbar and Henbest (1942, p. 99) pointed out the differences between *W. euthysepta* and *W. henbesti* (Skinner, 1931): *W. henbesti* is larger at 10 volutions than *W. euthysepta* at 11 volutions. *W. euthysepta* is also smaller than *W. ellipsoides* Dunbar and Henbest. *W. ellipsoides* is considered sufficiently different from *W. euthysepta* because it has a different shape and several more volutions than do the large specimens of *W. euthysepta*

Distribution.–*W. euthysepta* was described from the Stonefort Limestone Member of the Spoon Formation in Illinois. In Kentucky, it was found in outcrop samples of the Yeargins limestone member (informal usage) of the Tradewater Formation and in core samples correlated with those beds. In Ohio, it is found in the Vanport Limestone Member of the Allegheny Formation. Specimens identified as *Wedekindellina* sp. that might be assignable to this species were found in rocks assigned to the Vanport in western Pennsylvania. Thompson (1934) described this species from 35 ft below the "White Breast Coal" in Iowa.

Specimens studied.–The types of this species from Illinois and of conspecific forms from Iowa were studied, in addition to surface and core samples from western Kentucky at localities 18, 21, 31, 32, 39, 40, and 41; and from Ohio at locality 83.

Designation of types.–Dunbar and Henbest (1942) designated as a lectotype the specimen illustrated by Henbest (1928, pl. 8, fig. 6), which they reillustrated (1942, pl. 8, figs. 15–17).

TABLE 6.—*Measurements (in millimeters) for* Fusulinella stouti *Thompson, 1936*—Continued

Character	Measurements of fossils shown in plate 5, figures 10–18								
	10	11	12	13	14	15	16	17	18
Diameter of proloculus	0.09	0.06	0.09	0.12	0.07	0.08	0.08	0.095	0.12
Radius vector									
1	0.09	0.09	0.10	0.11	0.07	0.09	0.08	0.09	0.10
2	.15	.13	.14	.165	.10	.15	.12	.13	.15
3	.22	.23	.22	.23	.17	.22	.21	.19	.23
4	.30	.31	.34	.33	.23	.34	.28	.26	.31
5	.41	.45	.49	.46	.32	.43	.38	.34	.43
6	.54	.60	.64	.60	.43	.55	.49	.48	.58
7	.69	.75	.95	.75	.58	.69	.63	.61	----
8	.87	----	----	----	----	----	.76	----	----
Half length									
1	----	0.09	0.14	0.20	----	0.09	0.06	0.13	0.16
2	----	.18	.23	.26	----	.19	.15	.27	.31
3	----	.35	.40	.45	----	.30	.31	.36	.53
4	----	.48	.56	.62	----	.43	.48	.46	.80
5	----	.67	.94	.94	----	.58	.71	.65	1.15
6	----	.91	1.05	1.07	----	.76	1.00	.98	1.60
7	----	1.33	1.41	1.24	----	1.30	1.23	1.38	----
8	----	----	----	----	----	----	1.55	----	----
Volution height									
1	0.04	0.03	0.03	0.05	0.03	0.04	0.03	0.03	0.03
2	.05	.04	.04	.06	.04	.06	.04	.04	.05
3	.07	.09	.08	.07	.07	.065	.08	.06	.07
4	.08	.03	.12	.09	.05	.04	.07	.07	.09
5	.12	.14	.15	.14	.11	.10	.11	.08	.11
6	.12	.15	.15	.15	.11	.12	.11	.14	.15
7	.16	.16	.20	----	.14	.13	.14	.13	----
8	.19	----	----	----	----	----	.13	----	----
Wall thickness									
1	----	----	----	----	----	0.01	----	----	----
2	.01	.015	----	----	.01	.02	.01	----	----
3	.01	----	----	----	.02	----	.015	.01	.02
4	.02	.012	----	----	.02	.02	.02	.02	----
5	.02	.025	----	----	----	----	.03	----	----
6	----	----	----	----	.03	----	.035	.025	----
7	----	----	----	----	----	.03	----	----	----
8	----	----	----	----	----	----	----	----	----
Tunnel width (axials) or septal spacing									
1	----	0.01	0.02	0.03	----	----	0.03	0.01	0.02
2	.02	.03	.05	.05	.02	.03	.035	.02	.025
3	.03	.04	.05	.05	.04	.04	.05	.03	.04
4	.04	.08	.06	.07	.04	.05	.05	.05	.09
5	.05	.09	.12	----	.05	.07	.10	.075	.15
6	.05	.15	.17	.16	.06	.11	.145	.10	.19
7	.06	----	.21	----	----	.13	.16	.16	----
8	.10	----	----	----	----	----	----	----	----

Wedekindellina sp.

Plate 17, figures 7–9

Discussion.—Limestone attributed to the Vanport Limestone Member of the Allegheny Formation in Mercer County, Pa., has scattered immature fusulinids. The three specimens figured suggest the inner volutions of *Wedekindellina* and are at the proper stratigraphic level to represent *W. euthysepta* (Henbest). Their presence is worth noting, but a positive identification cannot be made. The specimens are from locality 86. Measurements are given in table 10.

Beedeina sp. aff. *B. novamexicana* (Needham),1937

Plate 8, figures 1–3, 5, 6; plate 9, figures 3–10; plate 10, figures 1–8, 10, 11

Description.—Measurements for these specimens are given in table 11 and on figure 15. The specimens are all small relative to the types of *Beedeina novamexicana* and to many of the specimens assigned to the species by Dunbar and Henbest (1942, p. 113–115). Most of the specimens from Kentucky have five to six volutions, whereas specimens from New Mexico and Illinois commonly have eight. Most specimens have the inflated fusiform shape with convex to irregular lateral slopes, a narrow irregular tunnel bordered by high narrow chomata. The septa are numerous but irregularly spaced, especially in the outer volutions. They are tightly and irregularly fluted throughout. The proloculus is relatively large, measuring 0.10–0.21 mm in maximum outer diameter, most specimens showing 0.15 mm or more. One of the specimens studied (pl. 9, fig. 3) has a more elongate fusiform shape in the outer volutions and suggests a similarity to *B. illinoisensis* (Dunbar and Henbest, 1942); however, it has less regular septal fluting.

TABLE 6.–*Measurements (in millimeters) for* Fusulinella stouti *Thompson, 1936*–Continued

Character	Measurements of fossils shown in plate 5, figures 19-26							
	19	20	21	22	23	24	25	26
Diameter of proloculus	0.08	0.10	0.17	0.14	0.08	0.10	0.09	0.08
Radius vector								
1	0.09	0.12	0.08	0.06	0.06	0.08	0.08	0.07
2	.14	.18	.13	.11	.105	.14	.15	.10
3	.20	.25	.19	.15	.17	.20	.19	.17
4	.29	.33	.26	.21	.24	.30	.29	.23
5	.38	.43	.36	.31	.34	.39	.41	.32
6	----	.53	.45	.46	.46	.52	.55	.44
7	----	----	.58	.60	----	.73	----	.56
8	----	----	.72	----	----	----	----	.71
Half length								
1	----	0.12	0.11	0.08	----	0.14	0.13	----
2	----	.24	.23	.17	----	.29	.24	----
3	----	.38	.42	.31	----	.41	.48	----
4	----	.65	.61	.46	----	.59	.64	----
5	----	.80	.94	.70	----	.86	.80	----
6	----	1.12	1.10	1.13	----	1.28	.95	----
7	----	----	1.33	1.41	----	1.73	----	----
8	----	----	1.78	----	----	----	----	----
Volution height								
1	0.03	0.06	0.02	0.02	0.02	0.03	0.03	0.025
2	.05	.06	.05	.04	.045	.05	.04	.03
3	.05	.07	.06	.05	.065	.06	.06	.05
4	.09	.08	.07	.07	.06	.10	.10	.06
5	.09	.105	.10	.10	.10	.08	.13	.08
6	----	.10	.09	.13	.12	.14	.14	.12
7	----	----	.13	.16	----	.20	----	.12
8	----	----	.15	----	----	----	----	.16
Wall thickness								
1	0.005	----	0.02	----	----	0.02	0.01	----
2	.01	.02	.02	----	----	.02	.015	----
3	.01	.03	.03	.01	.015	.02	.03	----
4	.015	.025	.035	.02	.015	.03	.03	.015
5	----	.02	.03	.02	.02	.02	----	.015
6	----	----	.03	.03	.03	.04	----	.02
7	----	----	.05	.04	----	----	----	.025
8	----	----	.04	----	----	----	----	.035
Tunnel width (axials) or septal spacing								
1	0.02	----	0.04	----	----	0.04	0.03	0.02
2	.025	.02	.04	.03	----	.04	.04	----
3	.04	.05	.07	.035	.02	.06	.06	.02
4	.03	.07	.11	.05	.035	.08	.09	.03
5	.04	.09	.16	.08	.05	.11	.12	.045
6	----	.11	.23	.10	.05	.14	----	.05
7	----	----	----	----	----	----	----	----
8	----	----	----	----	----	----	----	----

The spirotheca of *B.* sp. aff. *B. novamexicana* differs from that of most of the species of *Beedeina* seen in Kentucky in that it has a thin protheca but thick deposits of both inner and outer tectoria. The tectoria make the wall twice to three times the thickness of the protheca.

Distribution.–*B.* sp. aff. *B. novamexicana* is common in the Yeargins limestone member of the Tradewater Formation in both surface and subsurface samples. It has been described from localities 18 in Union County, 39 in Butler County, and 40 and 41 in Ohio County, Ky. The specimens from Illinois were described from the Stonefort Limestone Member of the Spoon Formation.

Beedeina leei (Skinner), 1931

Plate 8, figures 4, 7-9; plate 9, figures 1, 2; plate 10,figures 9, 12-17; plate 15, figures 7-13; plate 17, figures 10-15 24, 25

Fusulina leei Skinner, 1931, p. 257, 258, pl. 30, figs. 4-6; *non* Thompson, 1934, p. 301-303, pl. 21, figs. 3, 7, 10, 18; *non* Thompson, 1935, p. 305, pl. 26, figs. 17-19; Dunbar and Henbest, 1942, p. 109-111, pl. 5, figs. 1-8, pl. 6, figs. 1-10; Smyth, 1957, p. 266-267, pl. 2, figs. 17-19.

Fusulina aff. *F. leei* Thompson and Riggs, *in* Thompson, Shaver, and Riggs, 1959, p. 781, pl. 106, figs. 25-28, 33.

Fusulinella serotina Thompson, 1936, p. 677-678, pl. 90, figs. 1-4, pl. 21, figs. 9.

Fusulina serotina (Thompson and Riggs), *in* Thompson, Shaver, and Riggs, 1959, p. 780-781, pl. 106, figs. 29-32.

Description.–Measurements for this species are given in table 12 and on figure 16. This species of *Beedeina* is a relatively primitive form, in which the inner volutions are fusulinellid and only the outer volutions have septal fluting regular and intense enough to qualify for assignment to *Beedeina.* The specimens are fusiform to elongate fusiform and attain lengths of about 5 mm in 7½-8 volutions. The proloculus is small, averaging about 0.10 mm and ranging from 0.08 to 0.16 mm in maximum outside diameter.

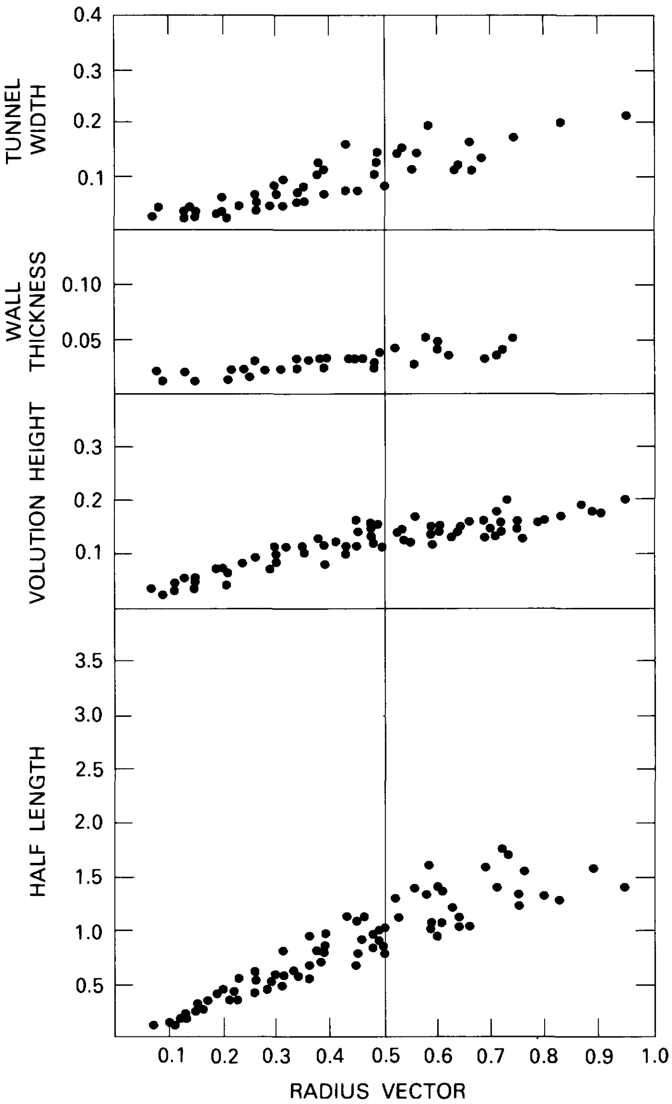


Figure 11.–Graphs for *Fusulinella stouti* Thompson, 1936. All measurements are in millimeters, and the values for each attribute are plotted against the radius vector.

The spirotheca is thin and composed of protheca and variable amounts of tectoria. Dunbar and Henbest (1942, p. 109) reported a thin inner tectorium and thicker outer tectorium. The specimens from Kentucky, Ohio, and Pennsylvania show a thick inner tectorium in the inner volutions, thinning in the outer volutions. The outer tectorium is thin in the inner volutions and absent in the outer volutions. The septa are closely but irregularly spaced. They are relatively straight in the inner volutions but become tightly fluted in the poles and across the shell in the outer volutions. The tunnel is generally straight and is bounded by high broad chomata in the inner volutions and by lower chomata in the outer volutions. The tunnel is high, extending more than half the volution height in most chambers.

Comparison and remarks.–*B. leei* is easily recognized by its fusulinellid initial volutions and *Beedeina* outer volutions, by its numerous, regularly expanding volutions, and by its thin spirotheca. The forms illustrated by Thompson from Iowa (1934) and Oklahoma (1935) have fewer, more loosely coiled volutions and do not show the typical *Fusulinella-Beedeina* transition. Specimens described by Thompson (1936) from Ohio as *Fusulinella serotina* fall completely within the range of variation of *B. leei*. *B. leei* differs from *B. carmani* in having a smaller proloculus, more volutions, and less widely spaced septa.

Distribution.–*B. leei* is a common form in beds of early Desmoinesian age from Oklahoma to Pennsylvania. The Kentucky specimens are described from the Yeargins limestone member of the Tradewater Formation from localities 18 in Union County, 32 in Christian County, 35 in Bulter County, and 40 in Ohio County. The Ohio specimens are described from the Putnam Hill Limestone Member of the Allegheny Formation at locality 79 in Coshocton County, and the Pennsylvania specimens are described from the Mahoning Limestone of Rogers (1858) at locality 87 in Armstrong County. Dunbar and Henbest (1942, p. 111) reported this species from their Curlew Limestone Member of the Spoon Formation. That unit is younger than the Curlew Limestone Member of Kentucky.

Beedeina sp. aff. _B. leei_ (Skinner), 1931

Plate 8, figures 10, 13, 15, 17; plate 12, figures 8–10

Several specimens from cores in western Kentucky bear a resemblance to *Beedeina leei* but cannot be assigned to this species with any confidence. Measurements for these specimens are given in table 12. A specimen from locality 21 in Webster County (pl. 8, fig. 10) shows inner volutions similar to those of *B. leei*, but the outer volutions do not expand in length like the typical form. Three specimens from locality 31 in Christian County are illustrated as plate 8, figures 13, 15, and 17. The microspheric axial shown in figure 13 is probably the same form as those shown in figures 15 and 17. These forms remain fusiform throughout their growth and do not elongate as in typical *B. leei*. The specimens illustrated on plate 12 as figures 8–10 may represent *B. leei* but are also less elongate and cannot be assigned with any certainty. They occur in a surface sample associated with *Wedekindellina*. All these specimens are found in association with *Wedekindellina* in beds assigned to the Yeargins limestone member of the Tradewater Formation.

TABLE 7.—*Measurements (in millimeters) for* Fusulinella iowensis *Thompson, 1934*

[Leaders (____), data not available or character absent]

Character	Measurements of fossils shown in plate 6, figures 8–11, 15, 12–14, 16								
	8	9	10	11	15	12	13	14	16
Diameter of proloculus ____	0.05	0.10	0.08	0.11	0.06	0.10	0.10	0.12	0.07
Radius vector									
1 ____	0.08	0.10	0.09	0.15	0.10	0.06	0.07	0.08	0.10
2 ____	.16	.16	.13	.25	.15	.10	.12	.13	.16
3 ____	.23	.25	.19	.36	.22	.19	.19	.19	.24
4 ____	.33	.34	.26	.46	.29	.28	.26	.30	.33
5 ____	.45	.42	.36	.62	.40	.38	.35	.39	.44
6 ____	.57	.56	.47	.76	.51	.49	.46	.51	.56
7 ____	.71	.71	.58	____	.65	.65	.60	.65	.72
8 ____	.88	____	.68	____	____	.77	.78	____	____
9 ____	____	____	____	____	____	.95	.95	____	____
Half length									
1 ____	0.09	0.15	0.11	____	____	0.08	0.07	____	0.14
2 ____	.14	.23	.19	____	____	.14	.12	____	.25
3 ____	.24	.41	.25	____	____	.22	.18	____	.40
4 ____	.33	.53	.35	____	____	.33	.27	____	.54
5 ____	.43	.67	.48	____	____	.48	.37	____	.78
6 ____	.56	.88	.70	____	____	.64	.53	____	.93
7 ____	.73	1.17	.82	____	____	.84	.72	____	1.22
8 ____	.95	____	1.07	____	____	1.14	.97	____	____
9 ____	1.22	____	____	____	____	1.33	1.18	____	____
Volution height									
1 ____	0.02	0.03	0.03	0.07	0.04	0.02	0.02	0.02	0.04
2 ____	.02	.06	.04	.09	.05	.04	.05	.05	.06
3 ____	.06	.08	.05	.11	.06	.06	.07	.06	.08
4 ____	.07	.09	.07	.10	.07	.11	.07	.10	.10
5 ____	.10	.09	.07	.10	.07	.11	.095	.10	.10
6 ____	.12	.15	.10	.15	.11	.13	.11	.12	.12
7 ____	.12	____	.11	____	.14	.16	.14	.13	.155
8 ____	.14	____	.10	____	____	.16	.18	____	____
9 ____	.17	____	____	____	____	.18	.19	____	____
Wall thickness									
1 ____	____	____	____	____	____	____	____	____	____
2 ____	0.02	____	____	0.01	____	0.02	____	0.02	____
3 ____	.02	____	____	.02	____	.015	____	.02	____
4 ____	____	____	____	.02	.02	.03	.02	____	____
5 ____	____	____	____	____	.02	____	____	____	____
6 ____	____	____	____	____	____	____	.03	____	____
7 ____	____	____	____	____	____	____	____	____	____
8 ____	____	____	____	____	____	____	____	____	____
9 ____	____	____	____	____	____	____	____	____	____
Tunnel width (axials) or septal spacing									
1 ____	0.02	0.02	0.02	0.02	0.02	____	0.02	0.01	0.03
2 ____	.025	.02	.02	.04	.04	.02	.04	.025	.04
3 ____	.03	.03	.02	.06	.04	.03	.05	.03	.04
4 ____	.04	.06	.04	.07	.04	.04	____	.04	.06
5 ____	.05	.08	.07	.08	.07	.05	.08	.04	.06
6 ____	.07	.08	____	____	.07	.07	.11	____	____
7 ____	.07	.11	____	____	____	.11	.17	____	____
8 ____	.14	____	____	____	____	.15	.21	____	____

Beedeina sp. aff. _B. spissiplicata_ (Dunbar and Henbest), 1942

Plate 8, figures 11, 12, 14, 16, 18–21; plate 9, figs. 11–16

Specimens from cores in wells resemble some of the specimens illustrated by Dunbar and Henbest (1942, pl. 7, figs. 1–12). The specimen they selected as the holotype (their figs. 3, 4) is more regular in coiling and fluting than the other specimens. The specimens from the Kentucky cores are similar to the specimen they illustrated as figure 5. The axis of coiling is apparently not straight, the tunnel is less regular, and the shape is not as constant as in the holotype.

Measurements for the Kentucky specimens are given in table 13 and on figure 17. These measurements agree, in general, with the data provided by Dunbar and Henbest (1942), although some of the Kentucky specimens are a little larger at comparable volutions.

The Kentucky specimens were found associated with *Wedekindellina* at the following locations: 31 in Christian County in core DDH, G16 at a depth of 36–138 ft; 33 in Muhlenberg County in core DDH, G10 at a depth of 150 ft; 35 in Butler County in core Gil-23 at a depth of 177.6 ft; 40 in Ohio County in core Gil-9 at a depth of 332 ft.

TABLE 7.—*Measurements (in millimeters) for* Fusulinella iowensis *Thompson, 1934*—Continued

Character	Measurements of fossils shown in plate 15, figures 14–18				
	14	15	16	17	18
Diameter of proloculus	0.065	0.09	0.10	0.06	0.06
Radius vector					
1	0.08	0.08	0.10	0.07	0.08
2	.12	.125	.17	.13	.12
3	.17	.18	.26	.20	.18
4	.22	.25	.35	.29	.26
5	.32	.35	.485	.425	.365
6	.44	.46	.62	.54	.52
7	.60	.63	.91	.68	.665
8	.74	----	----	----	----
9	----	----	----	----	----
Half length					
1	0.07	0.10	----	----	0.12
2	.11	.16	----	----	.21
3	.19	.28	----	----	.34
4	.30	.40	----	----	.45
5	.47	.71	----	----	.55
6	.66	.94	----	----	.94
7	.90	1.11	----	----	1.03
8	1.09	----	----	----	----
9	----	----	----	----	----
Volution height					
1	0.025	0.018	0.03	0.02	0.03
2	.04	.04	.065	.06	.04
3	.05	.05	.075	.07	.06
4	.05	.07	.09	.08	.08
5	.09	.09	.13	.14	.11
6	.12	.11	.135	.12	.15
7	.16	.16	.185	.14	.15
8	----	----	----	----	----
9	----	----	----	----	----
Wall thickness					
1	----	----	----	----	0.015
2	----	----	----	----	.018
3	----	----	.02	----	.025
4	----	----	.015	.02	----
5	----	.03	.035	.035	----
6	----	----	.04	.06	----
7	----	----	.065	----	----
8	----	----	----	----	----
9	----	----	----	----	----
Tunnel width (axials) or septal spacing					
1	0.03	0.025	0.02	0.025	0.03
2	.04	.045	.03	.025	.04
3	.04	.04	.025	.04	.055
4	.06	.07	.035	.05	.055
5	.07	.10	.04	.05	.08
6	.08	.12	.07	.06	.10
7	.10	----	----	----	----
8	----	----	----	----	----

The Illinois specimens were described from a limestone above the Colchester No. 2 coal bed. In Kentucky, the specimens come from the lower part of the Yeargins limestone member.

Beedeina henbesti Douglass n. sp.

Plate 16, figures 29–31

Name derivation.—Named for Lloyd G. Henbest, who collected the sample.

Diagnosis.—Shell small, fusiform, with nearly straight to concave lateral slopes and pointed poles. Septa tightly and regularly fluted throughout the shell. Proloculus relatively large.

Description.—Measurements are presented in table 14 and on figure 18. The shell develops regularly, maintaining a fusiform shape from its early volutions, expanding only slightly more rapidly along the axis than equatorially. The lateral slopes tend to be concave in most volutions. The proloculus averages 0.17 mm in four specimens, two specimens attaining a maximum outer diameter just greater than 0.20 mm. The spirotheca is thin and is composed of protheca and variable amounts of inner tectorium. A thin outer tectorium is deposited locally along the lateral slopes. The septa are intensely and regularly fluted throughout the shell. The septa are numerous and relatively evenly spaced, about 25 septa per volution in the fourth volution. The tunnel wanders a

TABLE 7. –*Measurements (in millimeters) for* Fusulinella iowensis *Thompson, 1934* – Continued

Character	Measurements of fossils shown in plate 15, figures 19-26							
	19	20	21	22	23	24	25	26
Diameter of proloculus	0.13	0.065	0.06	0.18	0.095	0.07	0.09	0.09
Radius vector								
1	0.11	0.09	0.065	0.13	0.10	0.09	0.09	0.12
2	.20	.12	.13	.21	.18	.14	.15	.195
3	.31	.165	.21	.315	.27	.20	.21	.28
4	.42	.26	.30	.45	.39	.31	.29	.39
5	.56	.375	.41	.58	.54	.40	.41	.51
6	.725	.51	.54	.76	.69	.51	.52	.645
7	----	.67	.71	.96	----	.67	----	.84
8	----	----	----	----	----	----	----	----
9	----	----	----	----	----	----	----	----
Half length								
1	0.14	----	----	0.19	0.10	0.10	----	----
2	.23	----	----	.31	.16	.17	----	----
3	.36	----	----	.445	.29	.29	----	----
4	.465	----	----	.62	.46	.40	----	----
5	.635	----	----	.90	.68	.55	----	----
6	.94	----	----	1.10	.965	.755	----	----
7	1.05	----	----	1.45	1.11	.95	----	----
8	----	----	----	----	----	----	----	----
9	----	----	----	----	----	----	----	----
Volution height								
1	0.03	0.02	0.03	0.04	0.03	0.02	0.035	0.04
2	.09	.04	.04	.09	.07	.04	.05	.07
3	.11	.04	.075	.10	.09	.06	.06	.08
4	.12	.10	.09	.13	.12	.10	.08	.09
5	.14	.11	.10	.14	.14	.10	.11	.12
6	.17	.125	.13	.18	.15	.11	.12	.13
7	----	.16	.16	.20	----	.16	----	.19
8	----	----	----	----	----	----	----	----
9	----	----	----	----	----	----	----	----
Wall thickness								
1	----	----	----	----	----	----	----	----
2	----	----	----	----	----	----	----	0.02
3	----	----	----	----	----	----	.01	.02
4	----	----	.025	----	----	----	.012	.025
5	----	.035	.04	.03	----	----	.035	.04
6	----	.05	.04	.06	----	----	----	.04
7	----	.07	.06	----	----	----	----	----
8	----	----	----	----	----	----	----	----
9	----	----	----	----	----	----	----	----
Tunnel width (axials) or septal spacing								
1	0.03	0.025	0.02	0.02	0.03	0.03	0.025	0.02
2	.05	.04	.02	.03	.04	.04	.03	.035
3	.07	.04	.03	.06	.065	.06	.03	.04
4	.07	.05	.03	.09	.09	.08	.05	.04
5	.10	.055	.04	.11	.125	.12	.07	.05
6	.14	.105	.04	.17	.19	----	----	.05
7	----	.125	----	----	----	----	----	----
8	----	----	----	----	----	----	----	----

little through the equatorial plane. It extends about half the volution height and is bordered by high narrow chomata.

Comparison and remarks. – *Beedeina henbesti* resembles some specimens of *B. leei* but has more regularly intensely fluted septa, more concave lateral slopes, and a large proloculus. It differs from *B. carmani* in shape and especially in the septal fluting; the prolocular diameter is comparable.

Distribution. – *B. henbesti* occurs in the Vanport Limestone Member of the Allegheny Formation in Stark County, Ohio, at locality 83. It is associated with the genus *Wedekindellina.*

Specimens studied. – Eleven specimens from collection f13109 were studied. The species was not recognized in other samples of the Vanport Limestone.

Designation of types. – The specimen illustrated on plate 16 as figure 29 is designated the holotype. The other specimens are paratypes.

Beedeina ashlandensis Douglass n. sp.

Plate 11, figures 1-19

Name derivation. – Named for Ashland, Ky., where outcrops on the Kentucky and Ohio sides of the Ohio River contain this species.

Fusulina pumila Thompson, 1934 (part) of Dunbar and Henbest, 1942, pl. 5, figs. 13-15.

Diagnosis. – Shell relatively small and rhombodial, expanding regularly and symmetrically. Chomata high and

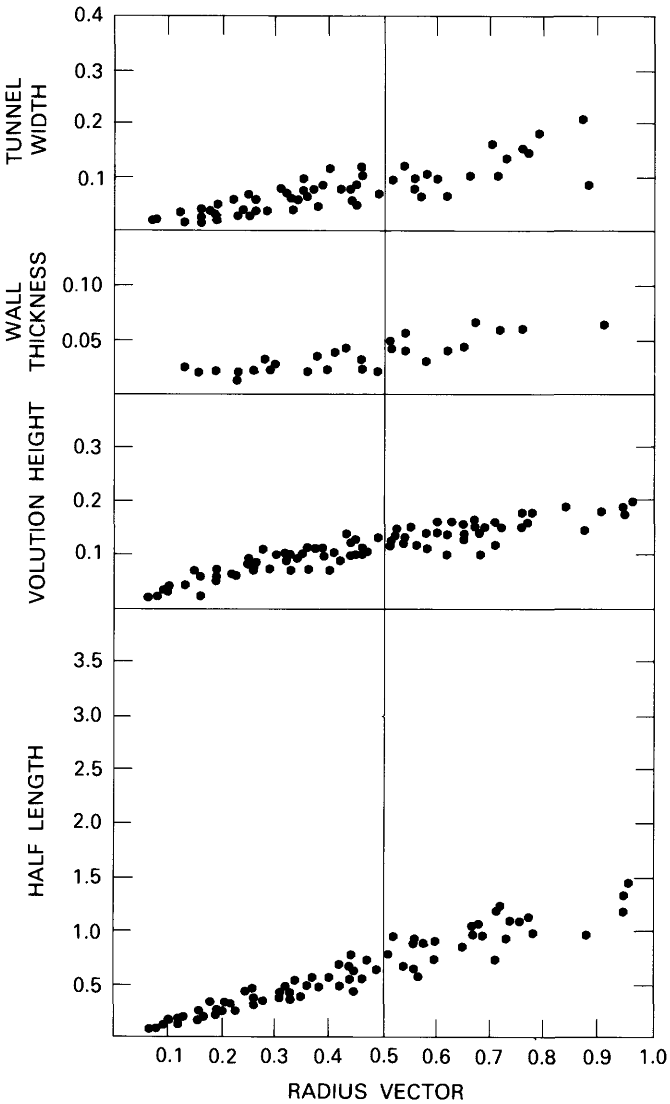


Figure 12.–Graphs for *Fusulinella iowensis* Thompson, 1934. All measurements are in millimeters, and the values for each attribute are plotted against the radius vector.

narrow, bordering a narrow tunnel. Septa closely spaced and fluted throughout the shell.

Description.–Measurements are presented in table 15 and on figure 19. Most specimens start with a rhomboidal shape and maintain a similar shape through the addition of whorls that tend to parallel each other with little elongation or increase in chamber height toward the poles. The proloculus averages a little more than 0.13 mm, ranging in maximum outer diameter from 0.08 to 0.19 mm.

The spirotheca is thin and composed of a protheca and generally well developed inner tectorium. An outer tectorium is present only sporadically. Septa are numerous and closely spaced. They are fluted strongly but irregularly, forming chamberlets in the vicinity of the tunnel. The tunnel tends to be straight and widens slowly. It is bordered by high narrow chomata. The tunnel extends about half the volution height.

Comparison and remarks.–*Beedeina ashlandensis* is similar to some of the specimens included in *Fusulina pumila* Thompson by Dunbar and Henbest (1942, pl. 5, figs. 13 and 14.). It is more regular in its growth form from inner to outer volutions than most species of *Beedeina*, but it fits in the general group within the genus that has attributes of *Fusulinella* in the inner volutions and those of *Beedeina* in the outer volutions. The change is primarily in the fluting of the septa but also includes the chomata shape and the spirothecal structure with little outer tectorium in the adult chambers.

Distribution.–This species is described from localities 61, 62, and 63 in Greenup County, Ky., and just across the Ohio River in Lawrence County, Ohio. The beds represent the upper part of the Allegheny Formation and probably are most closely tied to the Columbiana Limestone Member as mapped in Ohio. The specimens

TABLE 8.–*Measurements (in millimeters) for* Fusulinella *sp.*

[Leaders (----), data not available or character absent]

Character	Measurements of fossils shown in plate 6, figures 20, 17–19, 21, 22					
	20	17	18	19	21	22
Diameter of proloculus	0.09	0.11	0.09	0.07	0.09	0.10
Radius vector						
1	0.07	0.06	0.09	0.06	0.06	0.11
2	.11	.10	.15	.09	.12	.16
3	.16	.15	.21	.13	.18	.24
4	.24	.21	.28	.20	.28	.34
5	.32	.33	.38	.28	.36	.46
6	.43	.42	.52	.35	----	----
7	----	----	----	----	----	----
Half length						
1	----	0.05	----	----	0.06	----
2	----	.14	----	----	.11	----
3	----	.26	----	----	.21	----
4	----	.54	----	----	.38	----
5	----	.80	----	----	.63	----
6	----	1.16	----	----	1.01	----
7	----	1.43	----	----	----	----
Volution height						
1	0.02	0.02	0.02	0.02	0.02	0.03
2	.04	.04	.03	.03	.04	.05
3	.05	.05	.05	.04	.06	.08
4	.08	.06	.06	.06	.10	.10
5	.08	.11	.07	.08	.09	.13
6	.10	.11	.10	.08	----	----
7	----	----	.11	----	----	----
Wall thickness						
1	----	0.01	----	----	0.01	----
2	.01	----	----	----	.02	----
3	.02	----	----	.01	.02	.02
4	.02	.03	.02	.02	----	.02
5	.03	----	.02	.02	----	.04
6	----	.05	.02	.03	----	----
7	----	----	.04	----	----	----
Tunnel width (axials) or septal spacing						
1	0.02	----	0.01	0.02	0.02	0.03
2	.02	.02	.03	.02	.03	.04
3	.03	.03	----	.02	.03	.04
4	.04	.06	.03	.03	----	.045
5	.04	.08	.04	.04	.11	----
6	.05	.14	.05	.06	----	----
7	----	----	----	----	----	----

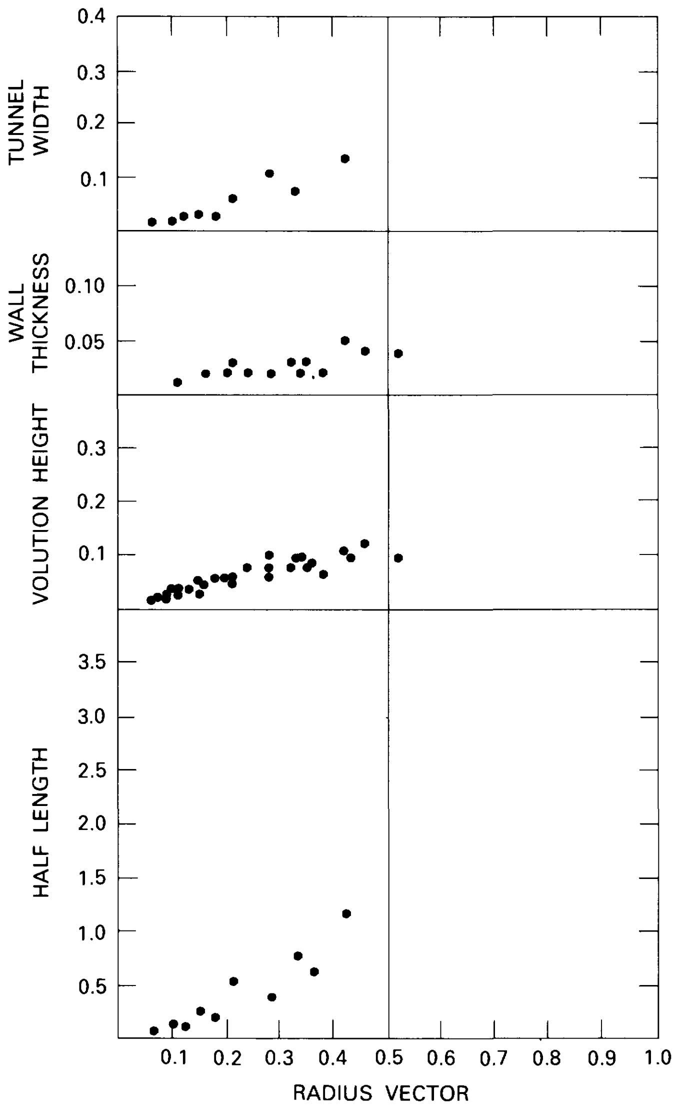


Figure 13.–Graphs for *Fusulinella* sp. All measurements are in millimeters, and the values for each attribute are plotted against the radius vector.

illustrated by Dunbar and Henbest (1942) are from the limestone tentatively assigned to the Seahorn? Limestone in Randolph County, Ill.

Specimens studied.–The description is based on 53 oriented thin sections from three collections. Comparative material was studied from the Dunbar and Henbest and the Thompson collections.

Designation of types.–The specimen illustrated as figure 18 on plate 11 is designated the holotype. The other illustrated specimens are paratypes.

Beedeina girtyi (Dunbar and Condra), 1927

Plate 12, figures 1-7; plate 13, figures 6, 9, 10

Fusulina ventricosa Meek and Worthen, 1873, p. 560, pl. 24, figs. 6, 8a.
Girtyina ventricosa Staff, 1912, p. 164, pl. 18, figs. 2, 5, 7.
Fusulinella girtyi Dunbar and Condra, 1927, p. 76-78, pl. 2, figs. 1-5.
Beedeina girtyi Galloway, 1933; p. 401, pl. 36, fig. 17; Ishii, 1958, p. 39, pl. 1, fig. 9.
Fusulina girtyi Thompson, 1934, p. 314-316, pl. 22, figs. 1, 5, 7, 20; Dunbar and Henbest, 1942, p. 115-117, pl. 11, figs. 1-17, pl. 12, figs. 2-8, 10, 11 (designated lectotype).

Description.–Measurements are given in table 16 and on figure 20. Shell inflated fusiform of moderate size, attaining lengths of about 5 mm and widths of 3 mm in eight to nine volutions. Some specimens attain 10 volutions and reach a length of 5.5 mm and a width of 3.5 mm. The inner volutions tend to be fusiform and to have concave lateral slopes, and the general shape is commonly maintained throughout, but some specimens have straight to slightly convex lateral slopes in the outer volutions. The proloculus in megalospheric forms ranges from 0.16 to 0.21 mm in maximum outer diameter. One microspheric form was sectioned, but the size of the proloculus could not be determined accurately.

The spirotheca is composed of a thin protheca and commonly heavy tectoria. In better preserved specimens, a fine fibrous structure can be determined in the diaphanotheca. The septa are strongly and regularly fluted in the outer volutions. They show less fluting in the inner volutions. The appearance of closed loops of the septa in equatorial section is characteristic of the outer volutions in this species. The loops are formed by the touching of opposing folds in the septa high up in the chamber. They do not indicate the presence of cuniculi. The tunnel is narrow, and its path ranges from straight to quite irregular. It is bordered by high broad chomata in the inner volutions and high narrow chomata in the outer volutions. No axial filling, as such, is recognized, but the chomata and epithecal deposits in the inner volutions do limit the open spaces in the inner chambers.

Comparison and remarks.–*Beedeina girtyi* is the type species for the genus and is an easily recognized form, but the limits of its variability are not well known. The type specimen was designated by Dunbar and Henbest (1942) in a footnote to a table of measurements. The specimen selected is more elongate than many of the other specimens illustrated for this species. It has a form ratio of about 1.7 and is at the high end of the form ratios reported for the species. This fact is only significant because *B. girtyi* is generally reported to occur with *B. illinoisensis* and (or) *B. haworthi* or *B. stookeyi*, all of which are reported to differ from *B. girtyi* primarily in being more elongate forms. Both Thompson (1934) and Dunbar and Henbest (1942) suggest the possibility that these specimens are variants and not distinct species. Perhaps collections from Kansas or Illinois might permit a study of the range of variability to help decide this issue. The collections available from Kentucky contain some elongate specimens and many in-

TABLE 9.—*Measurements (in millimeters) for* Wedekindellina euthysepta *(Henbest), 1928*

[Leaders (____), data not available or character absent]

Character	Measurements of fossils shown in plate 7, figures 1, 4, 6, 2, 7, 3, 8, 5							
	1	4	6	2	7	3	8	5
Diameter of proloculus	0.11	0.09	0.03?	0.11	0.07	0.10	0.08	0.06
Radius vector								
1	0.08	0.07	0.06	0.08	0.06	0.06	0.06	0.06
2	.11	.10	.09	.11	.09	.10	.08	.09
3	.15	.13	.12	.16	.13	.13	.11	.13
4	.20	.18	.19	.21	.17	.18	.15	.17
5	.24	.23	.24	.26	.22	.24	.21	.28
6	.30	.28	.31	.32	.28	.31	.28	.39
7	.34	____	.40	____	.36	.40	.37	.49
8	.40	____	____	____	.44	____	.45	.60
9	____	____	____	____	.55	____	.55	____
10	____	____	____	____	____	____	____	____
Half length								
1	0.12	0.14	0.08	0.17	____	0.14	0.12	____
2	.19	.23	.16	.30	____	.21	.21	____
3	.29	.32	.26	.43	____	.37	.33	____
4	.40	.44	.36	.63	____	.53	.45	____
5	.52	.59	.58	.78	____	.74	.58	____
6	.67	.78	____	.88	____	1.09	.75	
7	.83	____	____	____	____	1.40	.89	____
8	1.04	____	____	____	____	____	1.15	____
9	____	____	____	____	____	____	1.37	____
Volution height								
1	0.02	0.02	0.02	0.02	0.01	0.015	0.01	0.02
2	.04	.03	.03	.03	.02	.03	.01	.02
3	.04	.03	.03	.05	.04	.03	.025	.04
4	.05	.06	.03	.05	.04	.045	.03	.04
5	.04	.05	.04	.05	.045	.065	.06	.10
6	.06	.06	.07	.06	.06	.07	.07	.10
7	.04	____	.09	____	.07	.09	.09	.10
8	.09	____	____	____	.08	____	.09	.11
9	____	____	____	____	.11	____	.10	____
10	____	____	____	____	____	____	____	____
Wall thickness								
1	0.01	____	____	____	____	____	____	____
2	.01	.01	.01	.01	____	____	____	.005
3	.02	____	.02	.015	____	.02	.02	.01
4	.02	____	.02	____	.01	.02	____	.01
5	____	____	.02	.025	____	____	.02	.01
6	____	____	.04	____	.02	.025	____	.02
7	.02	____	____	____	.02	.04	____	.04
8	____	____	____	____	____	____	____	____
9	____	____	____	____	.03	____	____	____
Tunnel width (axials) or septal spacing								
1	____	____	____	____	0.02	____	____	____
2	.02	.03	.015	.02	____	.01	.01	.015
3	.03	.04	.02	.03	.02	.02	.02	.02
4	.04	.05	.04	.035	.04	.04	.03	.03
5	.05	.07	.09	.04	.03	.06	.06	.04
6	.06	____	.08	.06	.045	.07	.07	.05
7	.08	____	____	____	.05	.09	.08	.07
8	____	____	____	____	.045	____	.11	____
9	____	____	____	____	.065	____	.14	____
10	____	____	____	____	____	____	____	____

flated but shorter specimens. The problem cannot be resolved with the specimens available from Kentucky.

Distribution.—*B. girtyi* is present in the Providence Limestone Member of the Sturgis Formation in western Kentucky. It is common in the Herrin Limestone Member of the Carbondale Formation in Illinois and the Fort Scott Limestone of Kansas.

Specimens studied.—The specimens illustrated by Dunbar and Condra (1927) and Dunbar and Henbest (1942) were studied along with specimens from locality 27 in Hopkins County and locality 29 in Muhlenberg County, Ky.

Beedeina sp. aff. _B. haworthi_ (Beede), 1916

Plate 13, figures 1-5, 7, 8

Discussion.—Several specimens from the Providence Limestone Member of the Sturgis Formation in Muhlenberg County, Ky., resemble specimens illustrated by Dunbar and Henbest (1942) as *Fusulina haworthi* and as *F. illinoisensis*. These specimens tend to be more elongate and to have smaller chomata in the inner volutions than do the specimens that Dunbar and Henbest assigned to *F. girtyi*. *Beedeina girtyi* (as it is

TABLE 9.—*Measurements (in millimeters) for* Wedekindellina euthysepta *(Henbest), 1928*—Continued

Character	Measurements of fossils shown in plate 7, figures 10, 11, 9, 13, 14, 12, 16, 18							
	10	11	9	13	14	12	16	18
Diameter of proloculus	0.06	0.09	0.08	0.06	0.08	0.05	0.05	0.07
Radius vector								
1	0.06	0.06	0.06	0.06	0.065	0.06	0.07	0.08
2	.09	.08	.09	.10	.095	.09	.09	.12
3	.13	.11	.13	.14	.14	.12	.11	.16
4	.17	.14	.19	.21	.18	.15	.15	.21
5	.28	.17	.25	.28	.26	.20	.20	.26
6	.39	.25	.31	.35	.35	.26	.28	.34
7	.49	.32	.37	----	.41	.34	.34	.41
8	.60	.39	.46	----	----	.40	.41	.50
9	----	.48	----	----	----	.51	.49	.60
10	----	----	----	----	----	----	----	.74
Half length								
1	----	0.11	0.14	0.10	0.16	0.11	0.08	----
2	----	.21	.24	.20	.29	.20	.17	----
3	----	.30	.37	.34	.41	.31	.29	----
4	----	.38	.55	.50	.60	.42	.49	----
5	----	.52	----	.76	.87	.51	----	----
6	----	.69	----	1.14	1.11	.81	.78	----
7	----	.82	----	----	1.53	1.01	----	----
8	----	1.01	1.40	----	----	1.19	1.30	----
9	----	1.34	----	----	----	1.30	1.58	----
Volution height								
1	0.02	0.01	0.015	0.02	0.015	0.01	0.01	0.02
2	.02	.02	.025	.03	.045	.02	.02	.04
3	.04	.03	.04	.05	.09	.03	.02	.04
4	.04	.03	.06	.07	.13	.025	.04	.05
5	.10	.03	.055	.07	.21	.05	.05	.045
6	.10	.06	.06	----	.30	.06	.07	.07
7	.10	.08	.06	----	.36	.08	.07	.075
8	.11	.08	.09	----	----	.06	.07	.09
9	----	.09	----	----	----	.11	.08	.11
10	----	----	----	----	----	----	----	.13
Wall thickness								
1	----	0.075	0.01	----	0.018	----	0.01	----
2	.005	.01	.015	.01	.02	.01	.01	----
3	.01	.02	.02	.015	.015	----	.01	----
4	.01	----	----	.02	.02	.01	----	----
5	.01	----	----	----	----	.015	.015	.02
6	.02	.04	----	----	----	.02	----	----
7	.04	----	----	----	----	----	----	.02
8	----	----	----	----	----	.04	----	----
9	----	----	----	----	----	.04	----	.05
Tunnel width (axials) or septal spacing								
1	----	0.02	----	0.02	0.015	----	0.01	0.015
2	.015	.02	.02	.02	.02	----	.012	.02
3	.02	----	.035	.03	.03	----	.018	.025
4	.03	.06	----	.04	----	----	.03	.03
5	.04	----	.05	.07	.04	----	.05	.04
6	.05	.06	.07	1.05	----	----	----	.05
7	.07	.07	----	----	----	----	.06	.055
8	----	.09	----	----	----	----	.08	.05
9	----	----	----	----	----	----	.08	.09
10	----	----	----	----	----	----	----	.04

now known) occurs in the Kentucky collections of the Providence Limestone Member but was not seen in the same samples as the forms here discussed. The specimens illustrated on plate 13, figures 5 and 8, are considered juveniles. Figures 3 and 4 show the extremes of shape difference in the inner volutions, and figures 1 and 2 show well-developed mature specimens that are more robust than most of the specimens illustrated by Dunbar and Henbest (1942).

Measurements for these specimens are provided in table 17 and on figure 21. The specimens are from locality 29 in Muhlenberg County, Ky.

Beedeina acme (Dunbar and Henbest), 1942

Plate 14, figures 1–7

Fusulina acme Dunbar and Henbest, 1942, p. 122, pl. 15, figs. 1–18; pl. 16, fig. 14.

Description.—The specimens from the Madisonville Limestone Member of the Sturgis Formation in Kentucky bear a striking resemblance to those described by Dunbar and Henbest (1942) from the Lonsdale Limestone Member of the Modesto Formation in Illinois. Measurements for the Kentucky specimens are given in table 18 and on figure 22. The specimens are elongate fusiform and expand relatively rapidly in

TABLE 9.—*Measurements (in millimeters) for* Wedekindellina euthysepta *(Henbest), 1928*—Continued

Character	Measurements of fossils shown in plate 7, figures 19, 15, 17, 20–24							
	19	15	17	20	21	22	23	24
Diameter of proloculus	0.06	0.06	0.04	0.06	0.08	0.06	0.07	0.09
Radius vector								
1	0.07	0.06	0.06	0.06	0.06	0.07	0.06	0.09
2	.11	.09	.09	.06	.09	.09	.07	.13
3	.16	.12	.13	.08	.12	.12	.13	.17
4	.21	.18	.18	.11	.16	.15	.16	.21
5	.27	.24	.24	.15	.21	.22	.21	.28
6	.35	.32	.32	.20	.28	.29	.27	----
7	.46	.44	.44	.25	.36	.37	.32	----
8	----	----	.59	----	.45	----	----	----
9	----	----	----	----	----	----	----	----
10	----	----	----	----	----	----	----	----
Half length								
1	----	0.12	----	0.10	0.16	0.11	0.12	0.14
2	----	.28	----	.19	.35	.21	.25	.29
3	----	.38	----	.36	.50	.34	.40	.42
4	----	.51	----	.54	.64	.56	.51	.61
5	----	.80	----	.78	.84	.70	.65	.82
6	----	1.20	----	1.04	1.32	.90	.89	----
7	----	1.81	----	----	1.68	1.15	1.10	----
8	----	----	----	----	----	----	----	----
9	----	----	----	----	----	----	----	----
Volution height								
1	0.02	0.02	0.02	0.02	0.02	0.015	0.01	0.02
2	.04	.02	.03	.02	.03	.015	.03	.04
3	.05	.03	.04	.02	.04	.03	.035	.04
4	.05	.05	.055	.04	.05	.06	.04	.05
5	.06	.06	.06	.05	.07	.06	.05	.06
6	.08	.08	.08	.05	.08	.08	.065	----
7	.10	.11	.12	----	.09	----	.05	----
8	----	----	.15	----	----	----	----	----
9	----	----	----	----	----	----	----	----
10	----	----	----	----	----	----	----	----
Wall thickness								
1	----	0.01	----	----	----	0.02	----	----
2	----	.02	----	----	.02	----	.015	----
3	.01	.015	.01	.01	----	.015	.02	----
4	----	----	.012	.02	----	.02	.02	.018
5	.02	.03	.018	----	.03	.02	----	----
6	.03	----	.02	----	.04	.04	----	----
7	----	----	.025	----	----	----	----	----
8	----	----	.05	----	----	----	----	----
9	----	----	----	----	----	----	----	----
Tunnel width (axials) or septal spacing								
1	0.02	0.01	0.018	----	0.02	0.02	----	0.02
2	.02	.02	.02	.03	.03	.02	----	.03
3	.03	.04	.03	.04	.04	.04	.045	.04
4	.05	.07	.028	.06	.055	.05	.05	.04
5	.05	.08	.04	.08	.08	.09	.06	----
6	.05	----	.07	----	.09	----	.09	----
7	.055	----	.07	----	----	----	----	----
8	----	----	----	----	----	----	----	----
9	----	----	----	----	----	----	----	----
10	----	----	----	----	----	----	----	----

diameter and length. The proloculus is commonly close to 0.16 mm in maximum outer diameter, but some specimens are almost 0.19 mm. The spirotheca is thin and composed primarily of protheca. An inner tectorium is present in parts of the shell, and an outer tectorium is present in parts of the inner volutions. Septa are numerous and closely spaced. They are strongly and regularly to irregularly fluted, forming chamberlets throughout the outer volutions. The tunnel is narrow and irregular, bordered by small chomata that are broad in the inner volutions and narrow in the outer volutions.

Comparison and remarks.—*Beedeina acme* comes closer to the concept of *Fusulina* than any other fusulinid found in Kentucky. The thin spirotheca primarily composed of protheca, the elongate shape, the tightly fluted septa, and the small chomata all suggest a tendency toward *Fusulina*. The presence of chomata out to the last volution, the absence of axial filling, and the weak septal fluting in the inner volutions all show the greater affinity to the genus *Beedeina*. Most of the late Desmoinesian beedeinas are more fusiform and have more massive chomata than does *B. acme*.

Distribution.—This species is the youngest *Beedeina* found in Kentucky and among the youngest reported from Illinois. In Kentucky, it was found only in the Madisonville Limestone Member of the Sturgis Forma-

TABLE 9.–*Measurements (in millimeters) for* Wedekindellina euthysepta *(Henbest), 1928*–Continued

Character	Measurements of fossils shown in plate 7, figures 31, 27, 25, 33, 34, 28, 37, 29, 26								
	31	27	25	33	34	28	37	29	26
Diameter of proloculus	0.07	0.10	0.05	0.05	0.06	0.06	0.06	0.08	0.095
Radius vector									
1	0.09	0.06	0.04	0.06	0.06	0.04	0.08	0.065	0.07
2	.13	.10	.065	.07	.11	.06	.11	.10	.15
3	.18	.14	.09	.12	.16	.10	.15	.15	.20
4	.25	.19	.14	.19	.22	.16	.195	.19	.28
5	.32	.26	.18	.25	.30	.22	.265	.28	.36
6	----	.33	.24	.32	.39	----	.39	----	.44
7	----	.45	.42	.45	.52	----	----	----	----
8	----	.56	.52	----	----	----	----	----	----
9	----	----	----	----	----	----	----	----	----
10	----	----	----	----	----	----	----	----	----
Half length									
1	----	0.11	----	----	----	0.06	0.18	0.09	0.12
2	----	.28	----	----	----	.15	.30	.23	.22
3	----	.43	----	----	----	.26	.50	.37	.37
4	----	.58	----	----	----	.34	.76	.55	.59
5	----	.79	----	----	----	.52	1.13	.74	.875
6	----	1.00	----	----	----	----	----	----	1.17
7	----	1.32	----	----	----	----	----	----	1.44
8	----	1.72	----	----	----	----	----	----	----
9	----	----	----	----	----	----	----	----	----
Volution height									
1	0.18	0.01	0.015	0.02	0.02	0.015	0.02	0.02	0.02
2	.04	.035	.02	.02	.04	.02	.03	.03	.03
3	.045	.045	.03	.03	.04	.04	.04	.05	.045
4	.07	.05	.04	.06	.07	.06	.045	.04	.045
5	.08	.07	.04	.06	.07	.06	.07	.09	.08
6	----	.07	.07	.07	.09	----	.10	----	.08
7	----	.12	.08	.12	.13	----	----	----	.09
8	----	.11	.10	----	----	----	----	----	----
9	----	----	----	----	----	----	----	----	----
10	----	----	----	----	----	----	----	----	----
Wall thickness									
1	----	----	----	----	----	----	----	0.01	----
2	.01	----	----	----	----	----	----	.01	----
3	.01	----	.005	.015	.015	.01	----	.02	----
4	.015	.03	.01	.018	.02	.018	----	----	----
5	.03	.035	.01	.02	.02	----	----	----	----
6	----	.07	.015	.03	.025	----	----	----	----
7	----	----	.01	.04	.04	----	----	----	----
8	----	----	.02	----	----	----	----	----	----
9	----	----	----	----	----	----	----	----	----
Tunnel width (axials) or septal spacing									
1	0.025	----	0.03	0.018	----	0.02	0.025	----	0.04
2	.04	----	.03	.03	.015	.03	----	.028	.045
3	.04	.04	.05	.04	.025	.04	.06	.03	.06
4	.045	.065	.05	.04	.04	----	.075	.04	.08
5	.05	.08	.05	.06	.05	.06	.10	.05	.105
6	----	.11	.06	.08	.07	----	----	----	----
7	----	.13	.09	.05	.08	----	----	----	----
8	----	----	.13	----	----	----	----	----	----
9	----	----	----	----	----	----	----	----	----
10	----	----	----	----	----	----	----	----	----

tion at locality 26 in Hopkins County. It has been reported from the Lonsdale, Cutler (now included in the Piasa), and Piasa Limestone Members of Illinois.

Specimens studied.–The types from Illinois were studied in addition to 22 specimens from Kentucky.

Beedeina sp. aff. *B. acme* (Dunbar and Henbest), 1942

Plate 14, figures 8–12

Description.–One sample from beds mapped as Providence Limestone Member of the Sturgis Formation in Hopkins County, Ky., contains fusulinids more elongate than any found in the other samples of Providence. The specimens bear some resemblance to *Beedeina haworthi* (Beede) but are more like *B. acme* (Dunbar and Henbest), 1942. Measurements for these specimens are given in table 18. The specimens are elongate fusiform but do not elongate as rapidly as do specimens of *B. acme.* The proloculus ranges from 0.15 to 0.21 mm in outside diameter. The spirotheca is thin and composed of protheca and variable amounts of epitheca, principally outer tectorium. The protheca in some specimens shows clearly the fine keriothecal or fibrous structure. The septa are tightly and regularly fluted. Septal pores are common and especially visible at the poles. The tunnel is narrow and irregular, bordered by low narrow

TABLE 9.—*Measurements (in millimeters) for* Wedekindellina euthysepta *(Henbest), 1928*—Continued

Character	Measurements of fossils shown in plate 16, figures 32, 34, 35; plate 7, figures 30, 38, 39, 32, 35, 36, 41, 42										
	32	34	35	30	38	39	32	35	36	41	42
Diameter of proloculus	0.07	0.10	0.05	0.02	0.08	0.09	0.06	0.05	0.07	0.07	0.07
Radius vector											
1	0.07	0.06	0.06	0.04	0.06	0.08	0.06	0.05	0.07	0.06	0.07
2	.095	.09	.09	.06	.08	.11	.09	.08	.11	.10	.10
3	.18	.13	.12	.09	.11	.14	.13	.12	.145	.13	.14
4	.23	.17	.16	.13	.15	.18	.18	.17	.20	.17	.19
5	.31	.24	.20	.17	.22	.25	.25	.21	----	.23	.22
6	.40	.31	.28	.22	.30	.34	.32	.29	----	.31	.28
7	----	.39	.36	.29	.40	.42	.41	.39	----	.39	.36
8	----	.50	.46	----	----	----	.52	.47	----	----	.46
9	----	----	----	----	----	----	----	----	----	----	.58
Half length											
1	0.16	0.15	----	----	0.14	0.10	----	----	----	0.12	----
2	.25	.26	----	----	.20	.16	----	----	----	.22	----
3	.38	.485	----	----	.26	.25	----	----	----	.38	----
4	.62	.70	----	----	.50	.38	----	----	----	.63	----
5	.875	.96	----	----	.88	----	----	----	----	.79	----
6	1.24	1.16	----	----	1.12	----	----	----	----	1.05	----
7	----	1.41	----	----	1.32	1.19	----	----	----	1.42	----
8	----	----	----	----	----	----	----	----	----	----	----
9	----	----	----	----	----	----	----	----	----	----	----
Volution height											
1	0.02	0.02	0.018	0.01	0.015	0.02	0.02	0.018	0.01	0.02	0.018
2	.025	.02	.025	.02	.02	.03	.03	.03	.03	.03	.03
3	.025	.04	.03	.025	.03	.03	.04	.03	.04	.03	.04
4	.05	.05	.035	.03	.04	.05	.05	.055	.05	.04	.05
5	.055	.06	.04	.04	.07	.07	.07	.05	----	.06	.035
6	.078	.07	.08	.07	.08	.09	.08	.06	----	.07	.05
7	.085	.08	.08	----	.10	.09	.085	.07	----	.08	.075
8	----	.11	.09	----	----	----	----	.10	----	----	.10
9	----	----	----	----	----	----	----	----	----	----	.12
Wall thickness											
1	----	----	----	----	----	----	----	----	----	0.01	----
2	----	----	----	----	----	.015	----	----	----	----	----
3	----	----	0.01	----	----	----	.005	----	.01	----	----
4	----	----	.012	.01	----	.02	.015	.015	----	.01	
5	----	----	.02	.01	----	.02	.03	----	----	.02	----
6	----	----	.02	----	.025	----	----	----	----	----	.01
7	----	.025	----	.015	----	----	----	----	----	.02	
8	----	----	----	----	----	----	----	----	----	----	.02
9	----	----	----	----	----	----	----	----	----	----	----
Tunnel width (axials) or septal spacing											
1	----	----	0.018	----	----	----	----	0.01	0.01	0.02	0.018
2	.03	.03	.018	----	.025	.02	.01	.015	.02	.03	.02
3	.03	.04	.018	.018	.04	.03	.028	.02	.025	.05	.02
4	.06	.055	.038	.02	.05	.06	.04	.05	.03	.06	.03
5	.075	.07	.04	.03	.06	.08	.045	.06	----	----	.03
6	----	.10	.05	.03	.08	.105	.05	.06	----	.08	.05
7	----	.11	.06	----	.09	----	----	----	----	----	.07
8	----	.14	----	----	----	----	----	.09	----	----	.06
9	----	----	----	----	----	----	----	----	----	----	.09

chomata that are commonly obscured by the septal loops.

Distribution.—These forms were found at locality 28 in Hopkins County, Ky. They are associated with rare specimens of a form more properly assigned to *B. girtyi* (Dunbar and Condra). 1927.

Beedeina carmani (Thompson), 1936

Plate 15, figs. 1–6

Fusulinella carmani Thompson, 1936, p. 678, 679, pl. 91, figs. 10–12
Fusulina carmani (Thompson) Smyth, 1957, p. 267, 268, pl. 2, figs. 13, 14, 20.

Description.—Measurements are presented in table 19 and on figure 23. The specimens are elongate fusiform after early volutions that are rhomboidal to fusiform. The shell expands rapidly and elongates along a straight to irregularly curved axis. The proloculus is moderately large, averaging more than 0.15 mm in maximum outer diameter, some specimens attaining 0.20 mm.

The spirotheca is thin and is composed of protheca and inner tectorium, with minor amounts of outer tectorium in limited areas. The septa are widely and fairly evenly spaced. They are weakly fluted in the inner volutions and more tightly fluted in the outer volutions, forming chamberlets all the way to the tunnel area. The tunnel is wide and about half the volution height. It is bordered by high narrow chomata in the inner volutions and smaller lower chomata at maturity.

Comparison and remarks.—*Beedeina carmani* resembles *B. leei* in general stage of development but starts with a larger proloculus, is more loosely coiled, and is not as large. The species was originally described as a *Fusulinella* because of its inner volutions but was later recognized as an early form of *Beedeina* on the basis of the septal fluting in the outer volutions.

Distribution.—*B. carmani* was described from the Vanport Limestone Member of the Allegheny Formation in Ohio and has not been recognized elsewhere. The specimens described and illustrated here are from localities 71 and 75 in Muskingum County, Ohio.

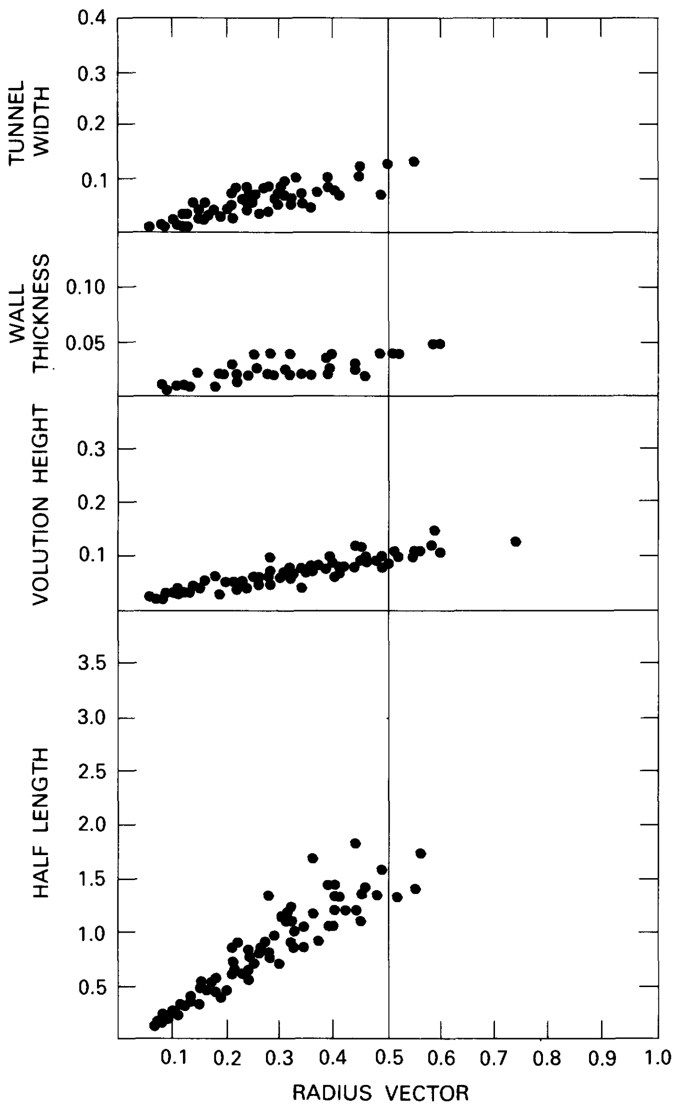


Figure 14.—Graphs for *Wedekindellina euthysepta* (Henbest), 1928. All measurements are in millimeters, and the values for each attribute are plotted against the radius vector.

TABLE 10.—*Measurements (in millimeters) for* Wedekindellina *sp.*

[Leaders (____), data not available or character absent]

Character	Measurements of fossils shown in plate 17, figures 7-9		
	7	8	9
Diameter of proloculus	0.07	0.10	0.10
Radius vector			
1	0.06	0.07	0.07
2	.09	.10	.095
3	.12	.14	.14
4	.16	.19	.19
5	.21	.29	____
Half length			
1	0.07	____	0.15
2	.18	____	.32
3	.31	____	.49
4	.45	____	.68
5	.60	____	____
Volution height			
1	0.02	0.02	0.02
2	.025	.03	.02
3	.04	.04	.04
4	.04	.04	.05
5	.05	.10	____
Wall thickness			
1	____	____	____
2	____	0.01	____
3	____	.025	____
4	____	.025	____
5	____	.022	____
Tunnel width (axials) or septal spacing			
1	____	0.02	0.03
2	.025	.025	.04
3	____	.03	____
4	.055	.04	____

***Beedeina* sp.**

Plate 17, figures 5, 6, 16–23

Description.—Measurements for these specimens are given in table 20. The specimens are small and inflated fusiform. They grow only to about four volutions, starting from a proloculus that has a maximum outer diameter near 0.10 mm. The innermost volutions are globular; later chambers become more elongate. The spirotheca is composed of protheca and variable amounts of inner and outer tectoria. No porous structure was seen in the diaphanotheca. The septa are weakly fluted. The tunnel is nearly straight, bordered by low narrow chomata that increase in height in the third volution.

Comparison and remarks.—These specimens may represent the juveniles of *Beedeina leei* (Skinner), a species that is found with them in one of the samples. In the other sample, they occur only with juvenaria of *Wedekindellina* sp. The nearly spherical chambers in the specimens represented as figures 5, 16, 17, 21, and 22 on plate 17 are not typical of the juvenaria of the associated *Beedeina* adults.

Distribution.—These specimens are from localities 86 and 87 in Mercer and Armstrong Counties, Pa. The rocks are assigned to the Vanport Limestone Member of the Allegheny Formation.

TABLE 11.—*Measurements (in millimeters) for* Beedeina *sp. aff.* B. novamexicana *(Needham), 1937*

[Leaders (----), data not available or character absent]

Character	Measurements of fossils shown in plate 8, figures 1, 2, 5, 6, 3; plate 9, figures 3–10												
	1	2	5	6	3	3	4	5	6	7	8	9	10
Diameter of proloculus	0.10	0.20	0.155	0.15	0.11	0.20	0.14	0.10	0.15	0.19	0.17	0.15	0.10
Radius vector													
1	0.12	0.18	0.16	0.10	0.11	0.17	0.17	0.09	0.16	0.17	0.17	0.11	0.09
2	.18	.30	.23	.19	.19	.25	.27	.15	.27	.26	.27	.18	.15
3	.30	.45	.37	.31	.32	.35	.39	.23	.40	.40	.42	.28	.23
4	.44	.63	.48	.46	.45	.51	.54	.31	.54	.595	.585	.39	.31
5	.61	.81	.65	.59	.59	.68	.76	.45	.78	.815	.78	.54	.45
6	.84	----	.82	----	.76	.97	.98	.70	1.00	1.07	----	.73	.70
7	----	----	----	----	----	1.15	1.20	----	----	----	----	.96	----
8	----	----	----			----	----	----	----	----	----	----	----
Half length													
1	0.16	0.18	0.20	0.24	----	0.22	----	0.15	0.22	0.21	----	----	0.17
2	.37	.35	.46	.37	----	.39	----	.27	.48	.36	----	----	.26
3	.56	.64	.62	.57	----	.75	----	.45	.66	.58	----	----	.58
4	.87	.90	.79	.85	----	1.28	----	.68	.855	.95	----	----	.87
5	1.15	1.21	.99	1.16		1.80	----	1.00	1.21	1.39	----	----	1.24
6	1.45	----	1.16	----	----	2.33	----	1.43	1.63	2.08	----	----	1.82
7	----	----	----	----	----	2.93	----	----	----	----	----	----	----
8	----	----	----	----	----	----	----	----	----	----	----	----	----
Volution height													
1	0.03	0.05	0.03	0.03	0.03	0.07	0.06	0.03	0.05	0.06	0.06	0.02	0.04
2	.07	.12	.04	.08	.07	.08	.095	.065	.11	.095	.10	.07	.05
3	.08	.14	.06	.12	.13	.10	.12	.07	.13	.13	.16	.09	.10
4	.12	.17	.08	.13	.13	.16	.16	.08	.14	.20	.16	.10	.13
5	.15	.18	.11	.16	.14	.17	.21	.13	.22	.22	.19	.15	.19
6	.20	----	.13	.16	----	.26	.22	.25	.25	.25	----	.19	.20
7	----	----	----	----	----	.21	.22	----	----	----	----	.23	----
Wall thickness													
1	----	----	0.02	0.02	----	----	0.01	----	----	0.01	0.01	0.005	----
2	----	.015	.025	----	.015	.02	----	----	----	----	.02	.01	.02
3	----	.02	.03	----	.02	----	----	----	----	----	.035	.015	.025
4	.02	----	----	.03	..03	.04	.04	----	.03	----	.04	.02	----
5	----	----	----	----	.07	----	.045	----	----	.04	.06	.045	----
6	----	----	.04	----	.09	.07	.10	----	.06	----	----	.07	.04
7	----	----	----	----	----	----	----	----	----	----	----	.08	----
Tunnel width (axials) or septal spacing													
1	0.04	0.045	0.04	0.03	0.025	0.04	0.03	----	0.03	0.03	0.03	0.04	0.03
2	.07	.07	.04	.05	.03	0.07	.03	.03	.05	.05	.04	.05	.04
3	.06	.10	.06	.07	.04	.08	.05	.05	.07	.07	.05	.06	.05
4	.11	.14	.08	.10	.06	.10	.07	.06	.12	.11	.07	----	.08
5	.20	----	.11	.14	.06	.19	----	.085	.15	.18	----	----	.11
6	.24	----	.13	----	----	.26	----	.145	.21	.25	----	.09	.16
7	----	----	----	----	----	.28	----	----	----	----	----	----	----
8	----	----	----	----	----	----	----	----	----	----	----	----	----

Triticites skinneri **Thompson, 1936**

Plate 16, figures 1–10

Triticites skinneri Thompson, 1936, p. 682, pl. 91, figs. 4–7; Smyth, 1957, p. 274, pl. 3, figs. 21, 22.

Diagnosis.—Shell small, inflated fusiform, with convex lateral slopes. Proloculus small, averaging 0.05 mm in maximum outer diameter. Tightly coiled, with seven to eight volutions, attaining length of 4–5 mm and width of as much as 2 mm.

Description.—Measurements are presented in table 21 and on figure 24. This species has a small proloculus that ranges in maximum outer diameter from about 0.03 to 0.07 mm, averaging 0.05 mm. The first volution in some specimens is nearly lenticular and at a large angle to the rest of the shell. The inner volutions are tightly coiled and elongate rapidly, but the outer volutions are more loosely coiled and more inflated in the equatorial area. The lateral slopes are nearly straight in the inner volutions but tend to be convex in the outer volutions.

The spirotheca is composed of protheca with distinct keriothecal structure in the outer volutions. The septa are strongly but irregularly fluted, forming chamberlets across the entire shell in the outer volutions. The septa are closely but irregularly spaced, 35–38 in the outer volutions. The tunnel is nearly straight and quite narrow. It ranges in height from less to more than half the volution height. It is bordered by low broad chomata in the inner volutions and higher but narrower chomata in the outer volutions.

Comparison and remarks.—*Triticites skinneri* resembles *T. moorei* Dunbar and Condra (1927) in size but is more tightly fluted, has a smaller proloculus, is more tightly coiled, and has a narrower tunnel angle. Smyth (1957, p. 276) compares *T. skinneri* with *T. cullomensis*

TABLE 11.—*Measurements (in millimeters) for* Beedeina *sp. aff.* B. novamexicana *(Needham), 1937*—Continued

Character	Measurements of fossils shown in plate 10, figures 1, 3, 2, 4–6, 10, 8, 11, 7									
	1	3	2	4	5	6	10	8	11	7
Diameter of proloculus	0.16	0.19	0.16	0.19	0.21	0.19	0.18	0.12	0.15	0.11
Radius vector										
1	0.07	0.10	0.12	0.10	0.11	0.16	0.011	0.13	0.12	0.12
2	.19	.18	.22	.16	.21	.24	.18	.20	.19	.20
3	.32	.27	.34	.25	.33	.38	.27	.29	.27	.37
4	.43	.42	.52	.41	.51	.58	.39	.45	.39	.51
5	.62	.56	.70	.59	..67	.80	.58	.61	.55	.66
6	.83	.73	.92	.78	.89	1.04	.75	.82	.75	.90
7	1.08	.90	1.13	----	----	----	.95	1.02	.96	
8	----	----	----	----	----	----	----	----	----	----
Half length										
1	0.24	0.14	0.16	0.14	0.30	0.28	0.11	0.09	0.24	----
2	.43	.29	.29	.30	.50	.42	.24	.20	.43	----
3	.57	.48	.56	.46	.67	.62	.44	.33	.57	----
4	.80	.76	.77	.78	.98	.96	.64	.54	.96	----
5	1.18	1.06	1.06	1.03	1.40	1.25	.99	.85	1.16	----
6	1.78	1.31	1.55	1.24	2.02	1.62	1.21	1.11	1.81	----
7	2.13	1.58	1.86	----	----	----	1.57	1.60	2.21	----
8	----	----	----	----	----	----	----	----	----	----
Volution height										
1	0.04	0.02	0.04	0.03	0.02	0.07	0.03	0.02	0.02	0.07
2	.08	.07	.09	.06	.10	.08	.06	.05	.04	.08
3	.12	.09	.12	.07	.11	.14	.10	.08	.07	.16
4	.12	.15	.17	.16	.17	.19	.12	.10	.08	.15
5	.18	.15	.19	.18	.16	.22	.18	.16	.12	.15
6	.21	.17	.21	.19	.22	.24	.18	.18	.16	.23
7	.24	.16	.21	----	----	----	.20	.22	.20	----
Wall thickness										
1	0.02	0.02	----	0.02	0.02	0.01	0.02	0.005	0.015	0.10
2	.03	.03	.02	.02	.02	.01	.02	.005	.02	.02
3	.03	.03	.03	.02	.04	.02	.03	.01	.03	.02
4	.03	.02	.02	.015	.04	.02	.02	.01	.03	.04
5	.04	.04	.03	----	.03	.03	.03	.02	.03	.04
6	.05	.03	.02	----	.04	.03	.04	.03	.03	----
7	.04	.02	.03	----	----	----	.04	.03	----	----
8	----	----	----	----	----	----	----	----	----	----
Tunnel width (axials) or septal spacing										
1	0.03	0.02	0.04	0.03	0.03	0.06	0.02	0.03	0.02	0.02
2	.03	.04	.07	.04	.05	.07	.03	.03	.03	.04
3	.09	.06	.10	.06	.06	.10	.06	.06	.05	.04
4	.14	.11	.15	.09	.10	.12	.08	.07	.09	.05
5	.14	.12	----	----	.13	.16	.10	.12	.13	.06
6	.23	.12	.26	.20	----	.18	.14	----	----	.09
7	----	.20	----	----	----	----	.18	----	----	----
8	----	----	----	----	----	----	----	----		

Dunbar and Condra (1927) but noted the smaller proloculus and narrower tunnel in *T. skinneri*. Except for the smaller proloculus, some juvenaria of *T. ricei* could be confused with those of *T. skinneri*, but the nature of the tunnel and the septal fluting distinguish them easily beyond the juvenarium.

Distribution.—*T. skinneri* has only been reported from the Ames Limestone Member of the Conemaugh Formation in Ohio.

Specimens studied.—Thompson's original material, including the types, was studied, in addition to topotypes from locality 69 in Perry County. Ohio.

Designation of types.—The specimen illustrated by Thompson (1936, pl. 91, fig. 6) is hereby designated the lectotype. It is specimen 1046A in the collections of the State University of Iowa. The specimens here illustrated are topotypes.

Triticites ricei **Douglass n. sp.**

Plate 16, figures 11–18

Name derivation.—Named for Charles L. Rice, who collected the sample containing this species and also many other samples for this study.

Diagnosis.—Shell elongate fusiform to elliptical, commonly one side flat or concave and the other convex, proloculus small, commonly less than 0.10 mm; shell expands slowly but uniformly, attaining nine volutions in some specimens.

Description.—Measurements are given in table 22 and on figure 25. The proloculus averages 0.09 mm in maximum outer diameter, ranging from 0.05 to 0.12 mm in 14 specimens. The shell is tightly coiled and tends to establish and maintain a uniform shape, each volution closely paralleling the others. The lateral slopes are generally convex, but many specimens have one flat-

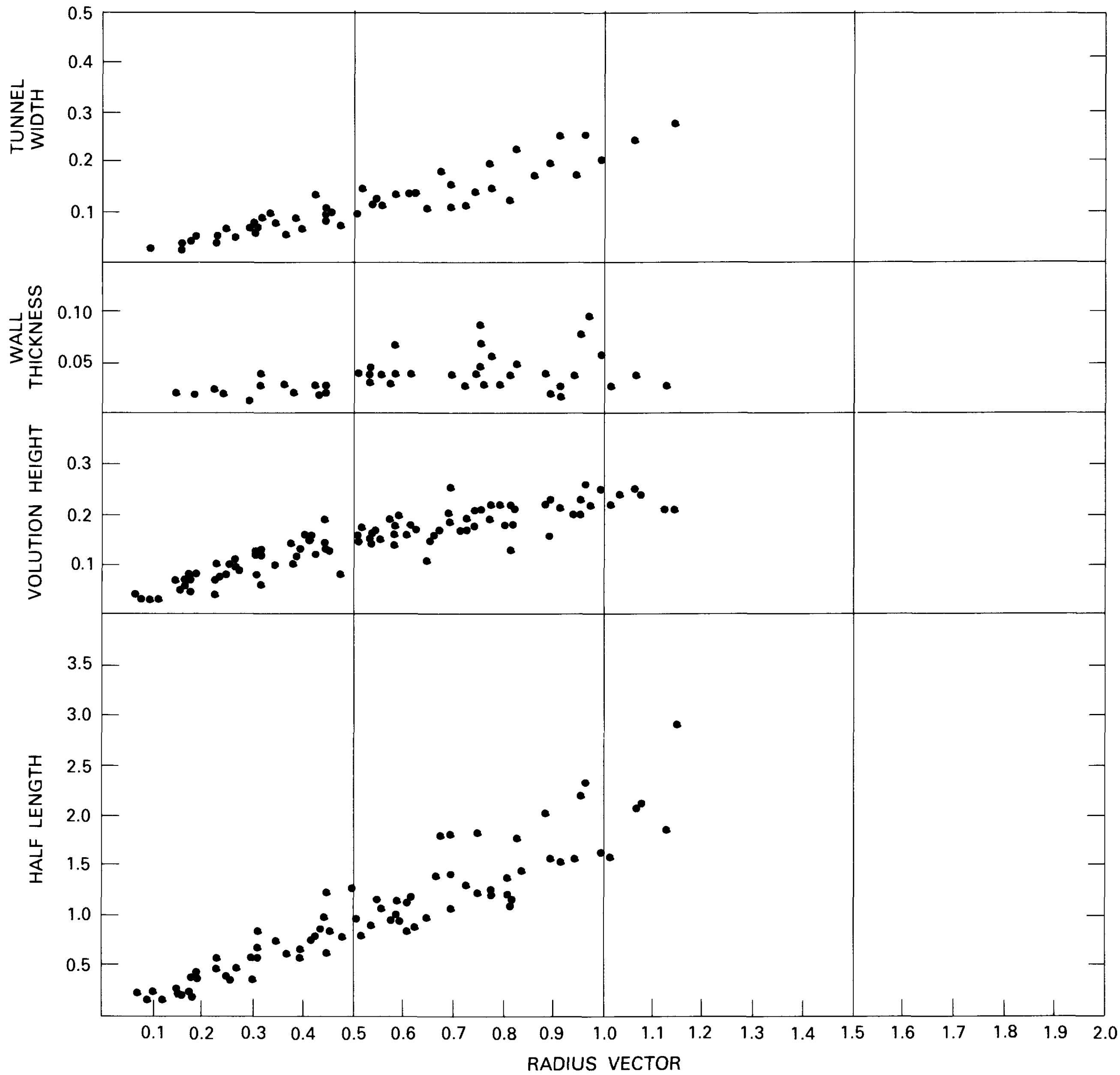


Figure 15.–Graphs for *Beedeina* sp. aff. *B. novamexicana* (Needham), 1937. All measurements are in millimeters, and the values for each attribute are plotted against the radius vector.

tened or even concave side. The spirotheca is composed of protheca with fine keriothecal structure. It is quite thin in the inner volutions and thickens gradually through the outer volutions. The septa are weakly fluted throughout most of the shell. Septa are numerous but irregularly spaced, some chambers being more than twice as wide as others. About 22 chambers are common in the seventh volution and 30 in the eighth. The tunnel is straight or wanders in a narrow equatorial zone; it extends less than half the chamber height and is limited by narrow chomata.

Comparison and remarks.–*Triticites ricei* differs from described species of *Triticites* in its tight uniform coiling, chambers maintaining nearly uniform height throughout much of their length. Some specimens of *T. cullomensis* bear a superficial resemblance to *T. ricei*, but they expand more rapidly, start with a larger proloculus, and have a thicker spirotheca.

Distribution.–*T. ricei* is known from the Ames Limestone Member of the Conemaugh Formation at locality 66 in Gallia County, Ohio.

Specimens studied.–Thirty specimens of *T. ricei* from collection f14005 at locality 66 were studied. Topotypes of *T. cullomensis* were sectioned for comparison.

TABLE 12.–*Measurements (in millimeters) for* Beedeina leei *(Skinner), 1931, and* B. *sp. aff.* B. leei *(Skinner), 1931*

[Leaders (___), data not available or character absent]

Character	Measurements of fossils shown in plate 8, figures 4, 8, 7, 9, 10, 13, 17, 15; plate 9, Figure 2								
	4	8	7	9	10	13	17	15	2
Diameter of proloculus	0.15	0.14	0.16	0.16	0.10	0.04	0.13	0.15	0.10
Radius vector									
1	0.18	0.12	0.13	0.11	0.10	0.05	0.12	0.15	0.10
2	.28	.19	.20	.19	.14	.09	.195	.23	.15
3	.36	.30	.31	.27	.22	.14	.29	.32	.20
4	.56	.44	.48	.41	.33	.22	.42	.45	.27
5	.75	.61	.62	.59	.63	.32	.60	.63	.39
6	----	.76	.82	.85	.72	.45	.85	.80	.51
7	----	----	----	----	----	.62	----	----	.66
8	----	----	----	----	----	----	----	----	.82
Half length									
1	----	0.13	0.18	0.13	0.18	0.09	----	0.24	0.13
2	----	.46	.38	.26	.35	.16	----	.38	.25
3	----	.79	.74	.44	.52	.24	----	.61	.48
4	----	1.10	1.05	.85	.71	.45	----	.985	.70
5	----	1.73	1.44	1.42	.97	.62	----	1.45	1.00
6	----	2.23	1.79	1.88	1.22	.84	----	1.80	1.26
7	----	----	----	----	----	1.20	----	----	1.45
8	----	----	----	----	----	----	----	----	1.72
Volution height									
1	0.07	0.03	0.05	0.04	0.02	0.01	0.03	0.03	0.04
2	.10	.06	.08	.07	.04	.03	.07	.07	.05
3	.10	.10	.10	.08	.07	.05	.09	.09	.07
4	.19	.17	.16	.17	.11	.08	.13	.13	.12
5	.19	.17	.16	.17	.21	.10	.18	.17	.12
6	----	.20	.20	.27	.22	.13	.245	.18	.15
7	----	----	----	----	----	.17	----	----	.16
Wall thickness									
1	0.02	----	----	----	----	----	0.02	0.01	----
2	.02	----	----	----	----	.01	.02	.02	.01
3	.02	.02	----	.025	.02	----	.025	----	----
4	.03	.06	.045	----	.03	----	.05	.04	.02
5	.04	.08	.05	----	----	----	.05	----	.02
6	----	----	----	----	----	----	.10	----	----
Tunnel width (axials) or septal spacing									
1	0.04	0.04	0.04	0.03	0.03	----	0.03	0.03	0.02
2	.045	.05	.05	.05	0.04	.03	.04	.05	.03
3	.05	.10	.09	.07	.06	.04	.05	.06	.05
4	.05	.14	.14	.16	.08	.05	.07	.10	.06
5	.06	.22	.23	.16	----	.08	.08	.10	.07
6	----	----	----	.22	----	.10	.08	----	.09
7	----	----	----	----	----	----	----	----	.16
8	----	----	----	----	----	----	----	----	.17

Designation of types.–The specimen illustrated on plate 16 as figure 11 is designated the holotype. The other specimens are paratypes.

Triticites ohioensis Thompson, 1936

Plate 16, figures 19–24; plate 18, figures 1–45

Fusulina secalica Condit, 1912, p. 44, 88

Triticites ohioensis Thompson, 1936, p. 680–682, pl. 91, figs. 1–3; Dunbar and Henbest, 1942, p. 130–132, pl. 19, figs. 1–22, pl. 20, figs. 20–24; Thompson, 1948, pl. 8, fig. 5; Smyth, 1957, p. 272–273, pl. 3, figs. 25–28; Thompson, 1957, p. 313–315, pl. 27, figs. 1–8; Ross, 1963, p. 108–109, pl. 7, figs. 7, 9–14.

Diagnosis.–Shell elongate fusiform with broadly rounded poles, attaining lengths of about 7.7 mm and widths of about 2 mm in 6½–7 volutions. Coiling tight and regular, but axis curved to irregular. Proloculus minute. Septa irregularly fluted and closely spaced.

Description.–Measurements are given in table 23 and on figure 26. The shape in the inner volutions is fusiform with sharply pointed poles, but the specimens elongate rapidly, and the poles are broadly rounded in the outer volutions. The volution height increases regularly throughout the shell, and the length increases regularly and rapidly, resulting in form ratios of 3–4 in most specimens and 4–4½ in some mature specimens. Commonly, the last volution or so has a lower form ratio.

The proloculus ranges from 0.05 to 0.15 mm in outer diameter, with a mean of 0.09 mm, and the shape is spherical. The thin wall is composed of a tectum and indistinct keriotheca, especially in the inner volutions. The maximum thickness approaches 0.06 mm in the mature specimens. The thickness is maintained throughout most of the length of the shell, thinning only at the poles.

The septa are closely and regularly spaced, except in the outer volutions of some specimens. The number of septa increases regularly from 9 in the first volution to about 25 in the last volution, but as many as 31 were

TABLE 12.—*Measurements (in millimeters) for* Beedeina leei *(Skinner), 1931, and* B. *sp. aff.* B. leei *(Skinner), 1931*—Continued

Character	Measurements of fossils shown in plate 10, figures 9, 12, 15, 13, 14, 16, 17; plate 12, figures 8, 10								
	9	12	15	13	14	16	17	8	10
Diameter of proloculus	0.07	0.05	0.08	0.17	0.10	0.11	0.17	0.09	0.18
Radius vector									
1	0.08	0.09	0.06	0.13	0.07	0.12	0.15	0.11	0.09
2	.13	.14	.12	.20	.11	.18	.22	.18	.13
3	.19	.21	.17	.30	.15	.27	.30	.23	.20
4	.29	.31	.25	.41	.21	.39	.39	.33	.26
5	.39	.42	.35	.56	.31	.53	.49	.42	.39
6	.57	.54	.48	----	.45	.68	.62	.59	.52
7	.79	.70	.63	----	.60	.94	.78	.77	----
8	----	.86	----	----	----	----	----	----	----
Half length									
1	----	----	----	0.29	0.09	0.14	0.28	0.10	0.10
2	----	----	----	.435	.19	.23	.42	.22	.20
3	----	----	----	.72	.39	.34	.77	.33	.37
4	----	----	----	1.00	.64	.53	1.00	.63	.63
5	----	----	----	1.34	1.13	.79	1.21	.89	1.09
6	----	----	----	----	1.65	1.27	1.44	1.15	1.75
7	----	----	----	----	2.35	1.69	2.10	1.70	----
Volution height									
1	0.03	0.03	0.02	0.05	0.02	0.04	0.07	0.02	0.03
2	.05	.04	.06	.07	.04	.06	.08	.02	.04
3	.06	.06	.05	.095	.04	.08	.08	.05	.06
4	.09	.10	.08	.11	.06	.13	.09	.07	.06
5	.10	.10	.10	.14	.09	.14	.10	.09	.12
6	.18	.13	.12	----	.14	.16	.13	.17	.12
7	.21	.16	.15	----	.15	.26	.15	.17	.13
8	----	.16	----	----	----	----	----	----	----
Wall thickness									
1	----	----	----	----	0.02	----	0.01	0.02	0.02
2	.02	.01	----	.02	.03	----	.02	.02	.02
3	.02	.02	.015	.03	.03	----	.02	.03	.03
4	.02	.02	.02	----	.04	.02	----	----	.02
5	.02	.03	.02	.05	----	.03	----	.04	----
6	.04	.03	.025	----	----	.02	----	----	----
7	----	----	.07	----	.04	----	----	----	----
Tunnel width (axials) or septal spacing									
1	0.02	0.02	0.02	0.03	0.03	0.04	0.04	0.02	0.02
2	.03	.02	.02	.05	.05	.06	.05	.04	.03
3	.03	.03	----	.08	.08	.08	.08	.05	.04
4	.03	.03	.03	.10	.11	.13	.11	.08	.07
5	.05	.04	.03	----	.19	.14	.14	.13	----
6	.05	.04	.04	----	----	.16	.19	.18	----
7	----	----	.05	----	----	.26	.30	----	----

observed in the last volution of one specimen. Septal pores are small but abundant and commonly visible not only in the poles but also across the middle of the shell in the outer volutions. Fluting is weak and irregular across the middle of the shell; the presence of chamberlets is rare, except in the polar areas.

The tunnel widens rapidly but irregularly, attaining widths near 1 mm in the outer volutions. The chomata are low and narrow but often appear to be high, broad, or even overhanging when the plane of a septum is included in the section. In tangential views, the extension of secondary deposits along the septa can be seen in some specimens. No axial filling or other epithecal deposits are present.

Comparison and remarks.—Plate 18 shows the full range of variation seen in this species from its early occurrences in the lower bed of the Brush Creek Limestone Member, through the Cambridge Limestone Member of the Conemaugh Formation in eastern Kentucky. The smallest forms at the bottom of the plate are from the oldest beds, and the changes through the units are illustrated by fusulinids from the younger units toward the top. The specimens from the upper beds are similar to the type and others from the Cambridge Limestone Member in Ohio, as illustrated on plate 16, figures 19-24.

At first glance, the specimens from the lower Brush Creek Limestone Member look quite different from those of the Cambridge Limestone Member, but the difference is principally the addition of volutions in the younger specimens. Plots of all the commonly measured attributes indicate a complete paralleling of growth through the fifth or sixth volution, where growth stops in the older specimens. The younger forms added one or more volutions, attaining 7½–8 volutions.

Distribution.—This species is common in rocks of early Missourian age. Its typical specimens are from the Cambridge Limestone Member of the Conemaugh Formation.

TABLE 12.—*Measurements (in millimeters) for* Beedeina leei *(Skinner), 1931, and* B. *sp. aff.* B. leei *(Skinner), 1931*—Continued

Character	Measurements of fossils shown in plate 15, figures 7-13						
	7	8	9	10	11	12	13
Diameter of proloculus	0.10	0.11	0.14	0.10	0.10	0.15	0.12
Radius vector							
1	0.12	0.11	0.11	0.13	0.12	0.11	0.12
2	.16	.15	.19	.17	.19	.175	.18
3	.23	.20	.27	.24	.28	.26	.27
4	.35	.30	.39	.35	.39	.38	.40
5	.48	.41	.60	.48	.55	.55	.56
6	.68	.55	.79	.63	.72	.75	.81
7	.88	.73	----	.82	----	----	----
8	----	----	----	----	----	----	----
Half length							
1	0.19	0.16	0.25	----	----	----	----
2	.40	.33	.445	----	----	----	----
3	.66	.50	.725	----	----	----	----
4	1.01	.695	1.02	----	----	----	----
5	1.52	.73	1.54	----	----	----	----
6	1.98	1.38	1.93	----	----	----	----
7	2.40	1.845	----	----	----	----	----
Volution height							
1	0.045	0.04	0.04	0.04	0.03	0.02	0.04
2	.05	.045	.07	.04	.07	.06	.06
3	.06	.05	.08	.06	.09	.08	.10
4	.12	.095	.11	.10	.11	.12	.12
5	.13	.115	.21	.13	.15	.165	.17
6	.20	.14	.20	.15	.18	.19	.15
7	.20	.18	----	.19	----	----	----
8	----	----	----	----	----	----	----
Wall thickness							
1	----	----	----	----	----	----	----
2	----	----	----	0.02	0.015	0.015	0.018
3	----	----	----	.02	.015	.03	.025
4	----	.03	.025	.03	.04	.05	.045
5	----	.05	.07	.035	----	.08	.06
6	----	.06	----	.07	----	----	.08
7	----	----	----	----	----	----	----
Tunnel width (axials) or septal spacing							
1	----	----	0.05	0.02	0.025	0.03	0.03
2	.05	----	.06	.04	.03	.04	.04
3	.07	.06	.095	.05	.04	.04	.04
4	.11	.14	.14	.03	.05	.05	.04
5	.20	.21	.20	.03	----	.035	.02
6	.20	.25	----	.02	----	----	.03
7	----	----	----	----	----	----	----

Specimens studied.—Several hundred thin sections from 15 samples were studied to recognize the lateral and vertical variation in this species.

Designation of types.—The specimen illustrated by Thompson in 1936 (his pl. 91, fig. 1) was reillustrated as a syntype by Thompson in 1948 (his pl. 8, fig. 5). In 1957 (p.314), Thompson referred to "the holotype of *T. ohioensis* but did not indicate the specimen he considered to be the type. I hereby designate the above specimen as the lectotype of *T. ohioensis.* It is here reillustrated on plate 16 as figure 19. It is specimen S.U.I. 1044B in the State University of Iowa collections. The specimen here illustrated on plate 16 as figure 20 is a paralectotype S.U.I. 1044A.

Triticites smythi **Douglass n. sp.**

Plate 16, figures 25–28

Name derivation.—Named for Pauline Smyth, who collected the sample and who has studied the fusulinids of Ohio.

Triticites venustus (part) Dunbar and Henbest, 1942, pl. 20, figs. 12, 13, 18, 19.

Diagnosis.—Elliptical to fusiform, relatively loosely coiled form, attaining length of 2.5–3 mm and width of about 1 mm in six volutions. Proloculus about 0.12 mm in maximum outer diameter. Tunnel narrow.

Description.—Measurements are presented in table 24 and on figure 27. The shell of this form is small and fusiform to elliptical, with convex lateral slopes and rounded poles. The shape is relatively constant throughout growth. The small proloculus is about 0.12 mm in maximum outer diameter. The spirotheca is thin and composed of protheca with very fine keriothecal structure. A suggestion of outer tectorium is found along parts of the lateral slopes. The septa are weakly and irregularly fluted. They are closely but irregularly spaced, forming about 20 chambers in the fifth volution. The tunnel is narrow and straight, bordered by low broad chomata. It extends more than half the height of the chambers in the outer volutions.

TABLE 12.—*Measurements (in millimeters) for* Beedeina leei *(Skinner), 1931, and* B. *sp. aff.* B. leei *(Skinner), 1931)*—Continued

Character	Measurements of fossils shown in plate 17, figures 10–15, 24, 25							
	10	11	12	13	14	15	24	25
Diameter of proloculus	0.16	0.15	0.11	0.12	0.08	0.11	0.12	0.09
Radius vector								
1	0.15	0.13	0.10	0.11	0.09	0.11	0.12	0.11
2	.23	.21	.15	.17	.12	.18	.21	.17
3	.33	.32	.23	.275	.18	.26	.30	.24
4	.44	.47	.34	.43	.24	.38	.39	.33
5	.58	.63	.49	.60	.35	.55	.54	.47
6	.77	.89	.67	----	.47	.74	----	----
7	.92	----	----	----	.60	----	----	----
8	----	----	----	----	----	----	----	----
Half length								
1	0.22	0.21	0.20	----	----	----	0.31	0.11
2	.41	.42	.41	----	----	----	.63	.32
3	.65	.74	.75	----	----	----	.82	.57
4	1.04	1.12	1.13	----	----	----	1.17	.92
5	1.34	1.91	1.42	----	----	----	1.56	1.23
6	1.82	2.04	1.78	----	----	----	----	----
7	2.19	----	----	----	----	----	----	----
Volution height								
1	0.06	0.04	0.03	0.035	0.02	0.04	0.02	0.04
2	.07	.08	.05	.06	.04	.06	.085	.06
3	.10	.10	.08	.11	.06	.08	.09	.06
4	.12	.15	.10	.16	.11	.12	.098	.09
5	.14	.16	.15	.17	.12	.17	.145	.135
6	.14	.25	.20	----	.14	.20	----	----
7	.20	----	----	----	----	----	----	----
8	----	----	----	----	----	----	----	----
Wall thickness								
1	----	0.018	----	0.01	----	----	----	----
2	----	.02	----	.015	.015	.015	----	----
3	----	----	----	.015	----	.015	----	.02
4	.05	.04	----	.03	.03	.02	.045	.03
5	.07	----	----	.04	.03	.04	----	.07
6	----	.11	----	----	----	.065	----	----
7	----	----	----	----	----	----	----	----
Tunnel width (axials) or septal spacing								
1	0.035	0.04	0.035	0.03	0.03	0.02	0.04	0.05
2	0.08	.07	.04	.035	.03	.025	.07	.05
3	.11	.08	.09	.04	.035	.04	.10	.08
4	.16	.10	.11	.06	.05	.06	.12	.10
5	.22	.16	.17	.05	.07	----	----	.17
6	.25	.24	.28	----	.06	----	----	----
7	----	----	----	----	.03	----	----	----

Comparison and remarks.—*Triticites smythi* is small and elliptical to fusiform with a narrow tunnel. It is easily distinguished from *T. ohioensis,* with which it occurs in Ohio, and from *T. venustus* in Illinois, both of which are more elongate and larger forms having a wider tunnel and more closely spaced septa. Three specimens illustrated as *T. venustus* by Dunbar and Henbest (1942, pl. 20, figs. 12, 13, 18, 19) resemble *T. smythi* quite closely; those three specimens are from the Livingston (?) Limestone, according to the authors. The other illustrated and described specimens assigned by Dunbar and Henbest to *T. vinustus* are from other localities.

Distribution.—*T. smythi* is recognized from the Cambridge Limestone Member of the Conemaugh Formation in Perry County, Ohio, at locality 69. The sample was collected by Pauline Smyth at her locality 33, where it is associated with abundant *T. ohioensis.* The specimens illustrated by Dunbar and Henbest, as mentioned above, are from their locality 490 from Christian County, Ill. where the specimens are also associated with *T. ohioensis.*

Designation of types.—The specimen illustrated on plate 16 as figure 25 is designated the holotype; the other illustrated specimens are paratypes.

Triticites cullomensis Dunbar and Condra, 1927

Plate 17, figures 1–4

Triticites cullomensis Dunbar and Condra, 1927, p. 93–95, pl. 5, figs. 5–10; Dunbar and Henbest, 1942, p. 135, pl. 23, figs. 13–18; Thompson, Verville and Bissell, 1950, p. 457–460, pl. 62, figs. 7–17, pl. 63, figs. 1-3; *non* Smyth, 1957, p. 273–274, pl. 3, figs. 23, 24; Slade, 1961, p. 70, pl. 10, figs. 5, 6; Sabins and Ross, 1963, p. 339, pl. 35, figs. 13–16.

Discussion.—The two specimens illustrated by Dunbar and Henbest (1942, pl. 23, figs. 17, 18) from Brilliant Cut, Pittsburgh, Pa. (locality 88), and two additional specimens from the same locality are illustrated here.

The exact horizon from which the specimens were obtained is not known. The original collection was made by Dr. William Darrah. With the help of H. B. Rollins of the University of Pittsburgh and colleagues Rucha Ingavat and C. H. Cheong, I was able to find some float material at Brilliant Cut containing *Triticites*. The source bed was not located.

Pauline Smyth (1957) reported *T. cullomensis* from the Ames Limestone Member of the Conemaugh Formation in Gallia County, Ohio. The two specimens that she illustrated have a small proloculus and are tightly coiled; these features suggest that the specimens are probably more closely related to *T. skinneri* than to *T. cullomensis*.

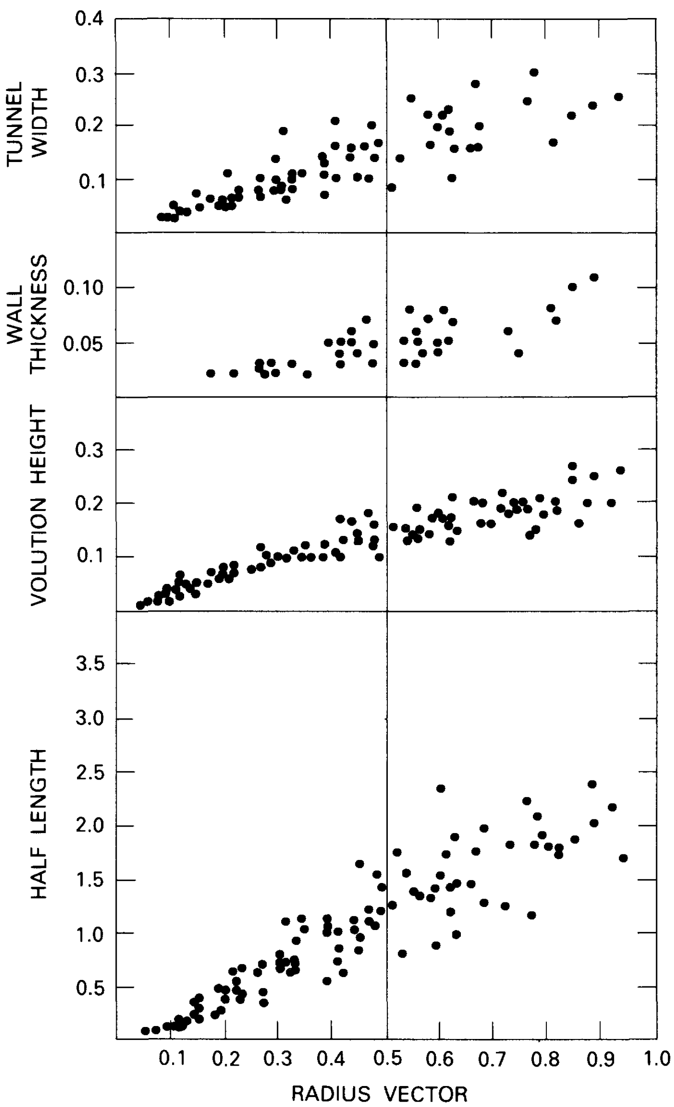


Figure 16.–Graphs for *Beedeina leei* (Skinner), 1931. All measurements are in millimeters, and the values for each attribute are plotted against the radius vector.

Triticites kehni **Douglass n. sp.**

Plate 19, figures 1–11

Name derivation.–Named for Thomas M. Kehn, who provided many samples and stratigraphic data from western Kentucky for this study.

Diagnosis.–Shell of moderate size, elongate fusiform to subcylindrical with nearly straight to slightly convex lateral slopes and rounded poles. Proloculus fairly large, 0.09-0.16 mm in maximum outer diameter. Spirotheca with fairly fine keriotheca. Septa irregularly spaced and irregularly fluted, chomata broad in inner volutions, high and narrow in outer volutions.

Description.–Measurements are presented in table 25 and on figure 28. Specimens elongate rapidly after the first volution, developing an elongate fusiform to subcylindrical shape, and attaining a length greater than 8 mm and a diameter of about 2.5 mm in about seven volutions.

The lateral slopes tend to be straight or slight convex, and the poles range from bluntly pointed in the inner volutions to broadly rounded at maturity. The proloculus ranges from 0.09 to 0.16 mm in maximum outer diameter, with a mean near 0.11 mm. The spirotheca is composed of protheca with relatively thin and fine keriotheca. The septa are strongly but irregularly fluted. They are irregularly spaced; about 24 chambers are found in the fourth volution, 28 in the fifth, and 25–32 in the sixth. The tunnel is nearly straight and widens rapidly in the outer volutions. It is bordered by low broad chomata in the inner volutions and high narrow chomata in the outer volutions. The tunnel is commonly less than half the chamber height.

Comparisons and remarks.–*Triticites kehni* has attributes intermediate between those of *T. ohioensis* Thompson and *T. iatensis* Thompson (1957). The fluting, though irregular, is more intense than in *T. ohioensis* and about the same as in *T. iatensis*. The elongate shape is more like that of *T. ohioensis* than that of *T. iatensis*. *T. kehni* is more loosely coiled than *T. iatensis*, and it commonly is more elongate and subcylindrical and larger. The number of septa and their fluting are similar. The proloculus in *T. kehni* is generally larger than that in *T. iatensis*, almost all the proloculi in *T. kehni* being larger than the mean for *T. iatensis*. *T. kehni* bears some resemblance to *Kansanella tenuis* (Merchant and Keroher, 1939), but *K. tenuis* is more slender and has more pointed poles throughout its growth.

Distribution.–*T. kehni* is found in the Carthage Limestone Member of the Sturgis Formation in Union and Webster Counties, western Kentucky, at localities 16 and 22. The rocks are of Missourian age.

Specimens studied.–Only 16 oriented sections of this species were prepared from the three samples available.

TABLE 13. –*Measurements (in millimeters) for* Beedeina *sp. aff.* B. spissiplicata *(Dunbar and Henbest), 1942*

[Leaders (____), data not available or character absent]

Character	Measurements of fossils shown in plate 8, figures 11, 12, 14, 16, 20, 18, 21, 19; plate 9, figures 11, 13, 15											
	11	12	14	16	20	18	21	19	11	13	14	15
Diameter of proloculus ____	0.09	0.11	0.125	0.10	0.10	0.11	0.075	0.11	0.11	0.095	0.10	0.09
Radius vector												
1 ____	0.10	0.08	0.12	0.08	0.10	0.12	0.09	0.10	0.10	0.10	0.13	0.11
2 ____	.18	.12	.18	.12	.14	.20	.13	.15	.165	.19	.21	15
3 ____	.33	.17	.26	.20	.18	.30	.19	.25	.25	.28	.30	.22
4 ____	.47	.22	.33	.30	.25	.40	.27	.37	.35	.44	.46	.31
5 ____	.71	.27	.43	.43	.36	.56	.43	.52	.48	.59	.60	.48
6 ____	.95	.37	.60	____	.53	.73	.64	____	____	____	____	____
7 ____	____	.50	____	____	____	____	.79	____	____	____	____	____
8 ____	____	.62	____	____	____	____	____	____	____			
Half length												
1 ____	0.14	0.19	0.18	0.17	0.13	____	____	0.22	0.22	0.21	0.21	____
2 ____	.26	.29	.37	.28	.26	____	____	.40	.39	.43	.45	____
3 ____	.52	.44	.58	.59	.42	____	____	.69	.58	.88	.76	____
4 ____	.76	.54	.85	.88	.64	____	____	1.10	.84	1.40	1.28	
5 ____	1.06	.71	1.16	.16	1.08	____	____	1.40	1.15	1.61	1.90	____
6 ____	1.45	.98	1.93	____	1.40	____	____	____	____	____	____	____
7 ____	____	1.23	____	____	____	____	____	____	____	____	____	____
8 ____	____	1.32	____	____	____	____	____	____	____	____	____	____
Volution height												
1 ____	0.03	0.02	0.04	0.02	0.02	0.05	0.03	0.02	0.03	0.03	0.05	0.03
2 ____	.14	.04	.06	.03	.04	.08	.04	.05	.06	.08	.07	.035
3 ____	.14	.05	.08	.08	.05	.09	.05	.095	.09	.09	.10	.07
4 ____	.16	.05	.09	.10	.07	.10	.09	.13	.10	.15	.145	.09
5 ____	.23	.07	.10	.13	.11	.15	.16	.15	.14	.15	.16	.165
6 ____	.26	.09	.17	____	.16	.19	.18	____	____	____	____	____
7 ____	____	.12	____	____	____	____	.19	____	____	____	____	____
8 ____	____	.13	____	____	____	____	____	____	____	____	____	____
Wall thickness												
1 ____	____	0.01	____	____	0.01	____	0.01	____	0.01	0.02	____	____
2 ____	____	.02	____	.02	____	.01	____	____	.02	____	.035	.02
3 ____	____	____	.02	____	____	.025	.015	.025	.025	.03	.04	.02
4 ____	____	.03	.025	.02	.03	____	.025	.06	____	____	____	.05
5 ____	.07	.03	____	.03	____	.03	.045	____	____	____	.05	.05
6 ____	____	____	.04	____	____	.05	.05	____	____	____	____	____
7 ____	____	____	____	____	____	____	____	____	____	____	____	____
Tunnel width (axials) or septal spacing												
1 ____	0.02	0.02	0.03	0.03	0.02	0.02	0.02	____	0.02	0.05	____	0.015
2 ____	.05	.03	.035	.04	____	.03	.03	.04	.03	.06	____	.02
3 ____	.11	.04	.05	.07	.05	.03	.035	.06	.05	.09	____	.03
4 ____	.12	.04	.07	.08	.08	.06	.05	.11	.09	.17	____	.04
5 ____	.17	.07	.08	____	.10	.06	.06	____	.15	.22	____	.04
6 ____	____	.10	____	____	.14	____	.07	____	____	____	____	____
7 ____	____	.10	____	____	____	____	____	____	____	____	____	____

The specimens are sparse in a limestone rich in other organic debris.

Designation of types. – The specimen illustrated on plate 19 as figure 5 is designated the holotype. The other specimens are paratypes.

Triticites callosus **Dunbar and Henbest, 1942**

Plate 20, figures 1–3, 5, 6

Triticites callosus Dunbar and Henbest, 1942, p. 136–138, pl. 21, figs. 15, pl. 22, figs. 1–11.

Description – Measurements for these specimens are shown in table 26 and on figure 29. Large inflated fusiform to rhomboidal specimens attaining 6–8 mm in length and 3–3.5 mm in width in seven to eight volutions. The inner volutions are tightly coiled and expand regularly. Two specimens illustrated by Dunar and Henbest (1942, pl. 22, figs. 2 and 5) attain lengths greater than 9 mm in 7½–8 volutions. The proloculus is large, having a range from 0.13 to 0.26 mm and a mean about 0.20 mm in seven specimens. The spirotheca thickens rapidly in the outer volutions and is composed of protheca with fine keriothecal structure. The septa are numerous, fairly evenly spaced, and irregularly fluted. Septal pores are common. The tunnel is narrow and wanders irregularly in the equatorial area. It is bordered by high narrow chomata. The tunnel extends to about half the chamber height.

Comparison and remarks. – The above description is based on the types and on topotypes. Most of the specimens found do not attain the large size described by Dunbar and Henbest, nor do they start with a proloculus as large as these authors reported. The specimens are more robust, larger, and more fluted than *Triticites cullomensus* Dunar and Condra, 1927, as noted by Dunbar and Henbest. The forms are associated with *T. mediocris* Dunbar and Henbest, 1942. Specimens of *T. mediocris* show many similarities to *T.*

callosus but are more elongate at each volution and do not attain a comparable size.

Distribution.—This species is only known from the Greenup Limestone Member of the Matoon Formation in Cumberland County, Ill., at locality 1. The rocks are of Virgilian age.

Specimens studied.—The types and three samples of topotypes were studied.

***Triticites mediocris* Dunbar and Henbest, 1942**

Plate 20, figures 4, 7–9

Triticites mediocris Dunbar and Henbest, 1942, p. 134–135, pl. 21, figs. 2–5, 7, 8, 16.

Description.—Measurements for these specimens are

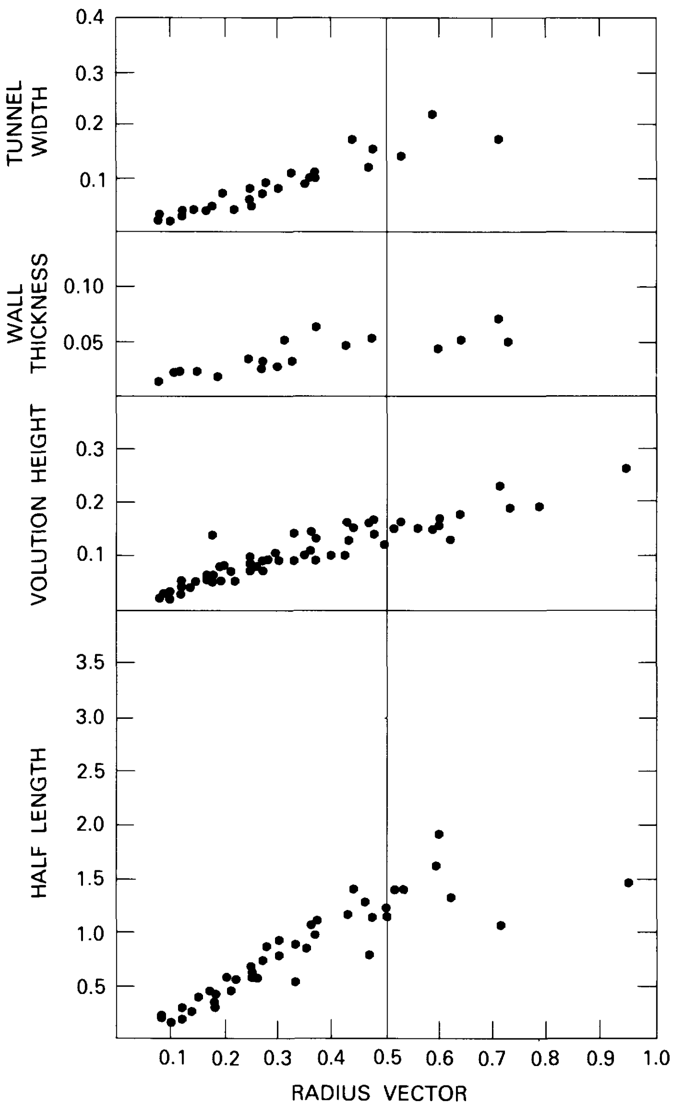


Figure 17.—Graphs for *Beedeina* sp. aff. *B. spissiplicata* (Dunbar and Henbest), 1942. All measurements are in millimeters, and the values for each attribute are plotted against the radius vector.

TABLE 14.—*Measurements (in millimeters) for* Beedeina henbesti *Douglass n. sp.*

[Leaders (____), data not available or character absent]

Character	Measurements of fossils shown in plate 16, figures 29–31		
	29	30	31
Diameter of proloculus	0.16	0.21	0.11
Radius vector			
1	0.14	0.15	0.10
2	.23	.23	.14
3	.31	.34	.20
4	.43	.48	.30
5	.61	.66	.45
6	.83	.84	.59
7	----	----	----
8	----	----	----
Half length			
1	0.22	0.20	----
2	.375	.32	----
3	.80	.64	----
4	1.20	1.03	----
5	1.62	1.49	----
6	2.11	1.99	----
7	----	----	----
8	----	----	----
Volution height			
1	0.03	0.03	0.02
2	.075	.07	.04
3	.08	.11	.06
4	.12	.135	.10
5	.18	.17	.14
6	.22	.19	.15
7	----	----	----
8	----	----	----
Wall thickness			
1	----	----	----
2	----	0.025	----
3	.02	.05	.015
4	.03	----	.015
5	.05	----	.04
6	----	----	.04
7	----	----	----
Tunnel width (axials) or septal spacing			
1	0.04	0.04	0.025
2	.05	.06	.035
3	.08	.07	.05
4	.12	.10	.05
5	.19	----	.03
6	.32	.24	.03
7	----	----	----
8	----	----	----

given in table 27 and on figure 30. The shell is elongate fusiform with irregular to convex lateral slopes and bluntly pointed poles. The proloculus ranges in maximum outer diameter from 0.07 to 0.20 mm, with a mean of 0.14 mm. The spirotheca is composed of protheca with fine but distinct keriotheca. It thickens rapidly in the outer whorls. The septa are numerous, fairly regularly spaced, and irregularly fluted throughout the shell. The tunnel is narrow and fairly straight, bordered by high narrow chomata. The tunnel is low, commonly less than half the chamber height.

Comparison and remarks.—The above description is based on the types and on topotypes. Some of the dimensions differ a little from those in the original description. Dunbar and Henbest (1942, p. 134) described the proloculus as ranging from 0.075 to 0.10 mm in diameter, but their table indicated correctly a range in their three

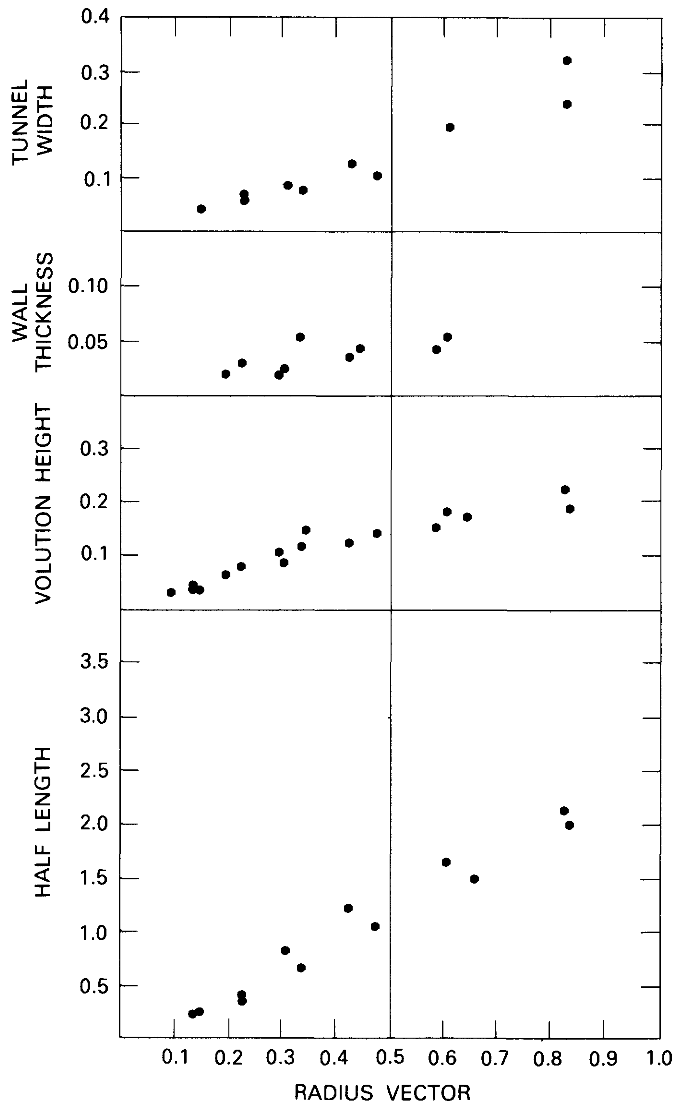


Figure 18.–Graphs for *Beedeina henbesti* Douglass n. sp. All measurements are in millimeters, and the values for each attribute are plotted against the radius vector.

specimens from 0.07 to 0.13 mm. Topotypes extend the range to 0.20 mm, and the specimen that they illustrated on their plate 21 as figure 7 is at the high end of this range.

Specimens of *Triticites mediocris* are more elongate at each volution than those of *T. callosus* with which they are associated, but they show similarity in most other attributes.

Distribution.–*T. mediocris* is known only from the Greenup Limestone Member of the Matoon Formation at locality 1 in Cumberland County, Ill. It is associated with *T. callosus* Dunbar and Henbest.

Specimens studied.–The types and topotype specimens from three samples were studied.

Designation of types.–The specimen illustrated by Dunbar and Henbest (1942, pl. 21, fig. 3) is hereby designated the lectotype.

Triticites beardi Douglass n. sp.

Plate 20, figures 10–15

Name derivation.–Named for John Beard, who collected many of the fusulinid samples from western Kentucky and Illinois for this study.

Diagnosis.–Shells rhomboidal, attaining lengths of 7 mm and widths of 3.6 mm in nine volutions. Proloculus large, averaging 0.17 mm. Spirotheca with coarse keriotheca. Tunnel straight and narrow with prominent high narrow chomata.

Description.–Measurements are presented in table 28 and on figure 31. Specimens expand regularly from a large proloculus, attaining an inflated fusiform to rhomboidal shape that elongates only slightly more rapidly than it expands equatorially. The proloculi range from 0.12 to 0.23 mm in maximum outer diameter and have a mean of 0.17 mm. The spirotheca is composed of protheca with coarse keriothecal structure. The septa are strongly but irregularly fluted across the entire shell. The tunnel is narrow and straight. It is bordered by prominent high narrow chomata.

Comparison and remarks.–*Triticites beardi* is similar in some ways to *Dunbarinella eoextenta* Thompson, 1954. It has the same general size of proloculus and overall size, and the development of the chomata is similar. The septa are more tightly fluted than in most of the specimens of *D. eoextenta,* including the type, and the keriotheca in *T. beardi* is coarser than that of *D. eoextenta.* These specimens are assigned to *Triticites* instead of *Dunbarinella* because they do not fit the definition of *Dunbarinella* Thompson, 1942 or 1954, and are more like the types of *Triticites* than the types of *Dunbarinella.*

Distribution.–*T. beardi* is known only from core samples at locality 19 in Union County, Ky. It represents a horizon younger than any other known fusulinid-bearing bed in the Eastern Interior Basin. The species is more advanced than *T. callosus* Dunbar and Henbest, 1942, from the Greenup Limestone Member of the Matoon Formation. The fossiliferous zone in the core is from unnamed beds of the Mauzy Formation of Early Permian age.

Specimens studied.–Ten specimens were obtained from the section of core at about 194-ft depth. Eight oriented sections were prepared.

Designation of types.–The specimen illustrated on plate 20 as figures 14 and 15 is designated the holotype. The other specimens are paratypes.

TABLE 15.—*Measurements (in millimeters) for* Beedeina ashlandensis *Douglass n. sp.*

[Leaders (----), data not available or character absent]

Character	Measurements of fossils shown in plate 11, figures 1, 2, 4, 5, 7, 8, 3, 6, 9, 10									
	1	2	4	5	7	8	3	6	9	10
Diameter of proloculus	0.17	0.15	0.12	0.19	0.12	0.15	0.10	0.16	0.12	0.17
Radius vector										
1	0.09	0.11	0.10	0.09	0.08	0.08	0.13	0.09	0.08	0.10
2	.14	.19	.17	.15	.12	.12	.21	.13	.14	.15
3	.19	.28	.27	.21	.17	.17	.28	.21	.20	.21
4	.27	.43	.39	.31	.24	.23	.39	.31	.30	.29
5	.37	.53	.56	.48	.34	.32	.52	.44	.42	.42
6	.51	.71	.75	.63	.36	.40	.73	----	.61	.54
7	.67	.88	----	----	.61	.56	----	----	----	.67
8	.88	----	----	----	.80	----	----	----	----	.89
9	----	----	----	----	----	----	----	----	----	1.15
Half length										
1	0.11	0.13	0.14	0.14	0.09	0.09	----	----	----	0.15
2	.23	.30	.34	.29	.19	.24	----	----	----	.26
3	.47	.50	.48	.41	.33	.41	----	----	----	.38
4	.62	.72	.81	.69	.57	.75	----	----	----	.60
5	.82	1.08	1.00	1.16	.89	1.08	----	----	----	.83
6	1.20	1.41	1.71	1.60	1.13	1.50	----	----	----	1.01
7	1.55	1.98	----	----	1.45	1.87	----	----	----	1.19
8	1.81	----	----	----	1.89	----	----	----	----	1.42
9	----	----	----	----	----	----	----	----	----	1.77
Volution height										
1	0.02	0.03	0.04	0.03	0.03	0.02	0.04	0.02	0.03	0.06
2	.04	.08	.07	.05	.04	.04	.07	.04	.06	.06
3	.06	.09	.10	.07	.06	.05	.07	.08	.07	.09
4	.08	.14	.12	.09	.07	.06	.11	.11	.10	.11
5	.10	.11	.17	.16	.09	.09	.14	.13	.12	.12
6	.13	.18	.19	.16	.11	.08	.20	----	.18	.13
7	.15	.17	----	----	.16	.16	----	----	----	.22
8	.22	----	----	.18	----	----	----	----	----	.26
Wall thickness										
1	0.02	----	0.02	0.02	----	----	----	----	----	----
2	----	.01	.02	----	.02	.02	.02	----	.01	----
3	.02	.02	.03	.02	----	.02	.03	----	----	----
4	.03	----	.04	.03	----	----	.04	----	.02	----
5	----	----	----	----	----	----	.06	----	.04	.03
6	----	.05	----	----	.03	.03	----	----	.06	.03
7	----	----	----	----	----	----	----	----	----	.05
8	----	----	----	----	----	----	----	----	----	----
Tunnel width (axials) or septal spacing										
1	0.03	0.03	0.03	----	0.02	0.03	0.02	0.04	0.01	0.03
2	.05	.04	.04	.04	.04	.04	.02	.05	.02	.04
3	.05	.05	.05	.05	.06	.06	.03	.06	.03	.05
4	.12	.07	.06	.10	.06	.08	.05	.10	.04	.09
5	.15	----	.13	----	.09	.14	.05	----	.05	.13
6	.15	.11	.28	----	.17	----	----	----	.05	.18
7	.22	.19	----	----	.17	.19	----	----	----	.20
8	----	----	----	----	----	----	----	----	----	----

TABLE 15.—*Measurements (in millimeters) for* Beedeina ashlandensis *Douglass n. sp.*—Continued

Character	Measurements of fossils shown in plate 11, figures 11, 17, 18, 16, 19, 13–15, 12								
	11	17	18	16	19	13	14	15	12
Diameter of proloculus	0.18	0.13	0.10	0.12	0.16	0.15	0.09	0.08	0.09
Radius vector									
1	0.11	0.11	0.09	0.12	0.11	0.12	0.08	0.10	0.08
2	.15	.15	.13	.21	.16	.18	.13	.17	.15
3	.22	.22	.20	.28	.24	.25	.18	.21	.21
4	.32	.31	.29	.44	.35	.35	.28	.29	.30
5	.42	.42	.39	.59	.44	.47	.38	.40	.40
6	.60	.61	.55	.77	.57	.63	.52	.56	.56
7	.77	.79	.69	.97	.74	----	.74	.68	----
8	.95	----	.83	----	.91	----	----	.86	----
9	----	----	----	----	----	----	----	----	----
Half length									
1	0.14	0.15	0.11	----	----	----	0.10	0.15	----
2	.19	.27	.23	----	----	----	.23	.24	----
3	.27	.45	.34	----	----	----	.32	.33	----
4	.40	.76	.50	----	----	----	.53	.52	----
5	.68	.94	.69	----	----	----	.95	.68	----
6	.87	1.29	.93	----	----	----	1.33	.96	----
7	1.09	1.61	1.17	----	----	----	1.75	1.50	----
8	1.27	----	1.45	----	----	----	----	2.15	----
9	----	----	----	----	----	----	----	----	----
Volution height									
1	0.03	0.03	0.03	0.05	0.02	0.04	0.02	0.04	0.02
2	.04	.05	.04	.08	.05	.05	.05	.04	.06
3	.07	.07	.06	.08	.07	.06	.06	.05	.07
4	.10	.09	.09	.14	.10	.11	.10	.09	.09
5	.13	.11	.10	.18	.09	.12	.11	.10	.09
6	.15	.13	.15	.18	.13	.15	.14	.15	.15
7	.17	.16	.13	.21	.17	----	.22	.13	----
8	.17	----	.15	----	.17	----	----	.18	----
Wall thickness									
1	----	----	0.01	----	----	0.01	----	----	----
2	----	----	----	----	.01	----	.02	.02	.01
3	----	.01	.01	.02	.02	.02	----	.03	----
4	----	.03	.03	----	.02	.03	.02	.04	.02
5	.02	.03	.03	.03	----	.03	----	.04	.04
6	.03	.03	----	.07	.03	----	.04	.04	.05
7	----	----	----	.06	.04	----	----	----	----
8	----	----	----	----	.07	----	----	----	----
Tunnel width (axials) or septal spacing									
1	0.02	0.03	0.02	0.03	0.01	0.03	0.03	0.03	0.01
2	.03	.04	.03	.03	.04	.03	.04	----	.02
3	.04	.07	.04	.04	.05	.02	.04	.05	.02
4	.06	.11	.06	.05	.05	.03	.05	.07	.03
5	.08	.16	.10	.05	.07	.06	.13	----	.04
6	.12	.20	.14	.06	.08	----	.16	.13	.04
7	.16	.30	.20	----	----	----	.25	.17	----
8	.26	----	.20	----	----	----	----	----	----

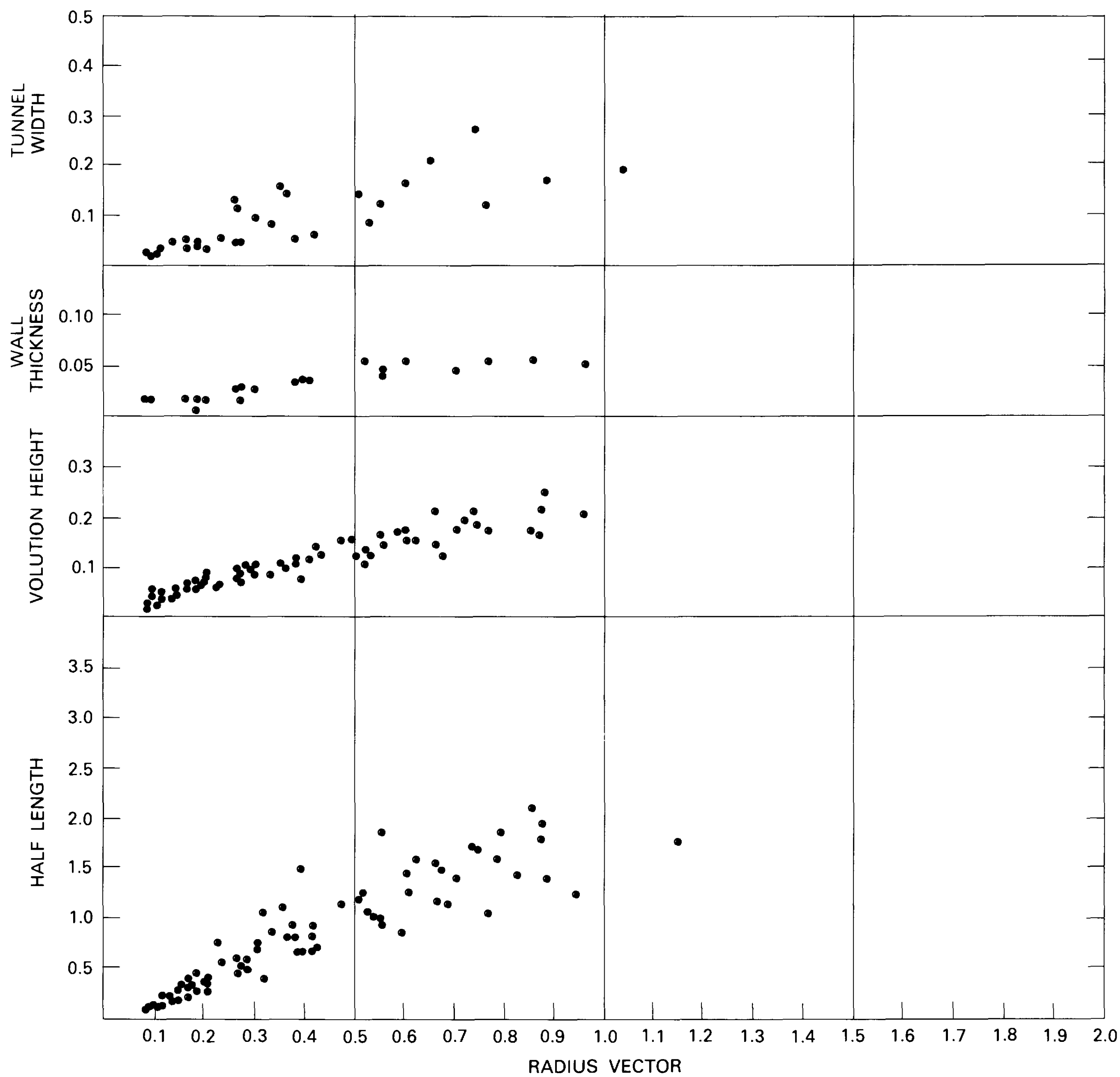


Figure 19. – Graphs for *Beedeina ashlandensis* Douglass n. sp. All measurements are in millimeters, and the values for each attribute are plotted against the radius vector.

TABLE 16.–*Measurements (in millimeters) for* Beedeina girtyi (*Dunbar and Condra), 1927*

[Leaders (____), data not available or character absent]

Character	Measurements of fossils shown in plate 12, figures 1, 3, 4, 2; plate 13, figures 9, 6, 10						
	1	3	4	2	9	6	10
Diameter of proloculus	0.21	0.18	0.08	0.12	0.19	0.21	0.16
Radius vector							
1	0.20	0.12	0.11	0.09	0.18	0.10	0.15
2	.29	.19	.17	.15	.25	.16	.19
3	.42	.29	.25	.24	.37	.24	.26
4	.55	.40	.35	.36	.49	.37	.38
5	.76	.58	.48	.62	.65	.50	.48
6	.96	.76	.60	.83	.85	.65	.64
7	1.16	.98	.79	1.07	1.07	.86	.77
8	1.43	1.15	.93	1.88	1.36	1.07	.97
9	1.78	____	1.15	____	____	1.31	1.20
10	____	____	____	____	____	____	1.40
Half length							
1	0.30	0.18	0.12	____	0.23	0.13	____
2	.49	.31	.16	____	.39	.27	____
3	.76	.43	.27	____	.59	.49	____
4	1.10	.63	.46	____	.81	.61	____
5	1.35	.98	.70	____	1.00	.78	____
6	1.78	1.35	.96	____	1.27	.95	____
7	2.28	1.74	1.22	____	1.56	1.24	____
8	2.73	2.39	1.57	____	1.97	1.53	____
Volution height							
1	0.08	0.05	0.03	0.03	0.06	0.03	0.04
2	.09	.07	.05	.05	.07	.06	.05
3	.12	.09	.08	.09	.12	.07	.06
4	.14	.11	.10	.12	.12	.12	.12
5	.20	.17	.12	.26	.18	.13	.09
6	.20	.19	.12	.21	.19	.15	.16
7	.20	.21	.19	.23	.21	.20	.14
8	.27	.17	.15	.31	.29	.21	.20
9	.35	____	.22	____	____	.24	.22
10	____	____	____	____	____	____	.21
Wall thickness							
1	0.02	0.02	0.02	0.02	0.03	0.02	0.02
2	.02	.02	.03	.02	.02	.02	.03
3	.02	.03	.02	____	.02	.02	.02
4	____	.02	.01	____	.02	.03	.03
5	.03	.03	.02	____	.02	.02	.04
6	.04	.03	____	____	.02	.04	.04
7	.05	.04	____	.06	.03	.03	.05
8	____	____	____	____	.04	.03	.11
9	____	____	____	____	____	.03	.08
10	____	____	____	____	____	____	.06
Tunnel width (axials) or septal spacing							
1	0.04	0.03	____	0.03	0.03	0.02	0.03
2	.05	.03	.04	.07	.06	.03	.03
3	.06	.09	.05	____	.06	.07	.04
4	.10	.12	.06	.08	.10	.09	.05
5	____	.18	.07	.08	.12	.14	.06
6	.14	.26	.08	.08	.15	.14	.12
7	,21	____	.10	.12	____	.16	.16
8	.35	____	.12	____	____	____	.14
9	____	____	.21	____	____	____	.20

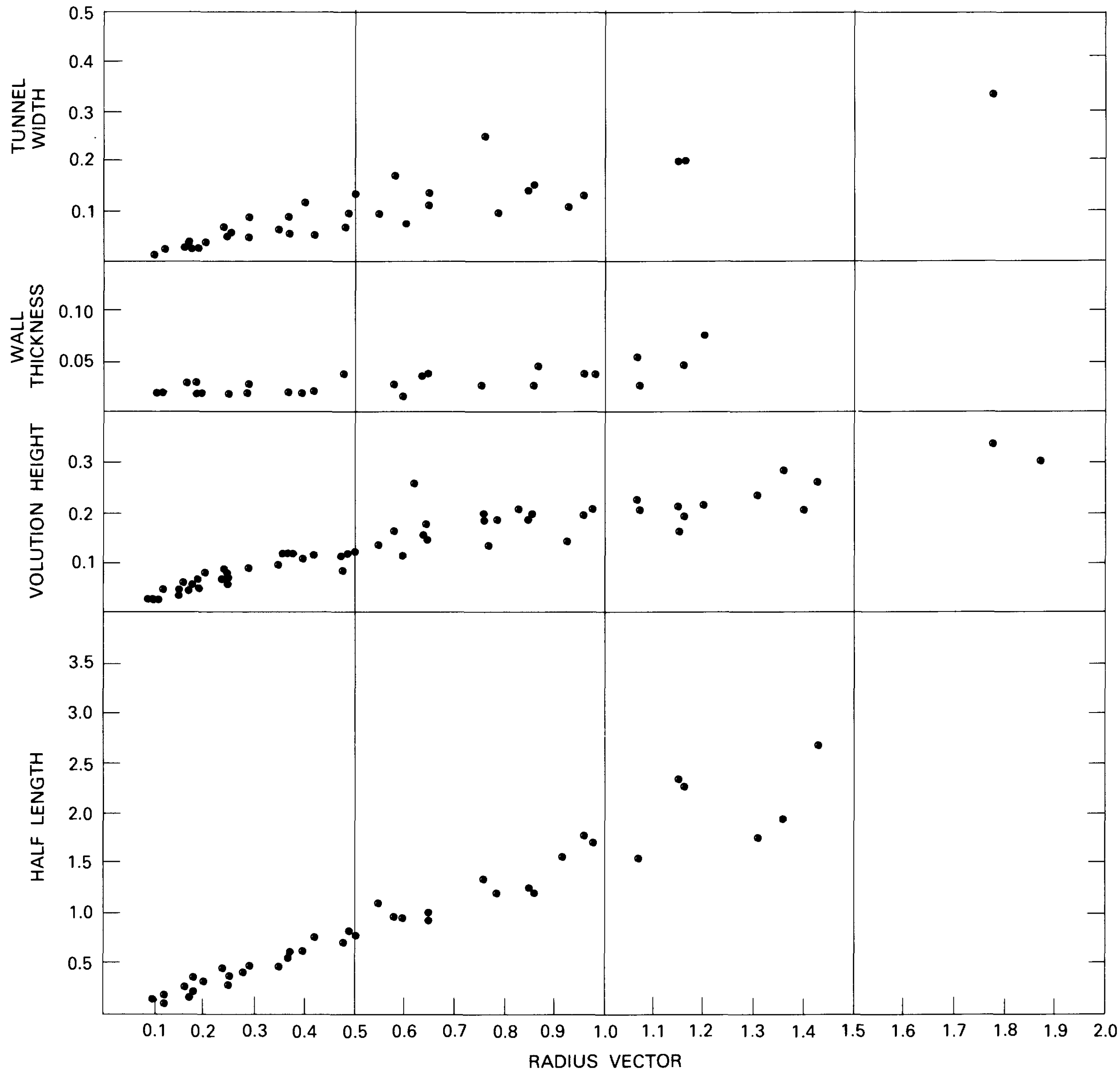


Figure 20.–Graphs for *Beedeina girtyi* (Dunbar and Condra), 1927. All measurements are in millimeters, and the values for each attribute are plotted against the radius vector.

TABLE 17.—*Measurements (in millimeters) for* Beedeina *sp. aff.* B. haworthi *(Beede), 1916*

[Leaders (____), data not available or character absent]

Character	Measurements of fossils shown in plate 13, figures 1, 4, 2, 3, 5, 8, 7						
	1	4	2	3	5	8	7
Diameter of proloculus	0.32	0.21	0.21	0.14	0.14	0.23	0.16
Radius vector							
1	0.15	0.15	0.19	0.11	0.09	0.13	0.17
2	.21	.26	.27	.17	.14	.22	.24
3	.31	.35	.39	.24	.23	.32	.34
4	.44	.52	.51	.35	.38	.49	.45
5	.59	.72	.69	.49	.52	.66	.62
6	.76	.92	.89	.69	----	----	.81
7	.95	1.18	1.40	.90	----	----	1.04
8	1.15	----	----	1.09	----	----	----
9	----	----	----	----	----	----	----
10	----	----	----	----	----	----	----
Half length							
1	0.19	0.32	----	0.16	0.15	0.19	----
2	.34	.49	----	.33	.34	.39	----
3	.72	.65	----	.49	.55	.67	----
4	1.05	.91	----	.67	.89	1.21	----
5	1.42	1.19	----	.93	1.28	1.57	----
6	1.97	1.62	----	1.26	----	----	----
7	2.32	2.26	----	1.68	----	----	----
8	2.93	----	----	----	----	----	----
Volution height							
1	0.03	0.05	0.04	0.03	0.03	0.04	0.05
2	.05	.11	.08	.06	.06	.09	.07
3	.09	.09	.11	.07	.10	.10	.10
4	.13	.17	.13	.11	.11	.17	.11
5	.15	.19	.17	.13	.16	.17	.16
6	.17	.21	.19	.21	----	----	.19
7	.20	.25	.25	.21	----	----	.22
8	.20	----	----	.19	----	----	----
9	----	----	----	----	----	----	----
10	----	----	----	----	----	----	----
Wall thickness							
1	----	----	0.02	0.01	0.01	----	0.02
2	.03	----	.02	.02	.02	.02	.01
3	.04	.04	.03	.03	.03	----	.03
4	.03	.04	.04	----	.02	.03	.03
5	----	----	.08	----	----	.05	.04
6	----	----	.10	.03	----	----	.07
7	.07	----	.08	.03	----	----	.07
8	----	----	----	----	----	----	----
9	----	----	----	----	----	----	----
10	----	----	----	----	----	----	----
Tunnel width (axials) or septal spacing							
1	0.06	0.03	0.03	0.03	0.02	0.03	0.03
2	.07	.06	.03	.04	.04	.04	.04
3	.10	.08	.04	.06	.04	.06	.04
4	.12	.10	.04	.07	.09	.07	.05
5	.15	.12	.07	.10	.17	.12	.06
6	.19	.21	.07	.14	----	----	.13
7	.26	.30	----	.23	----	----	.14
8	----	----	----	.25	----	----	----
9	----	----	----	----	----	----	----

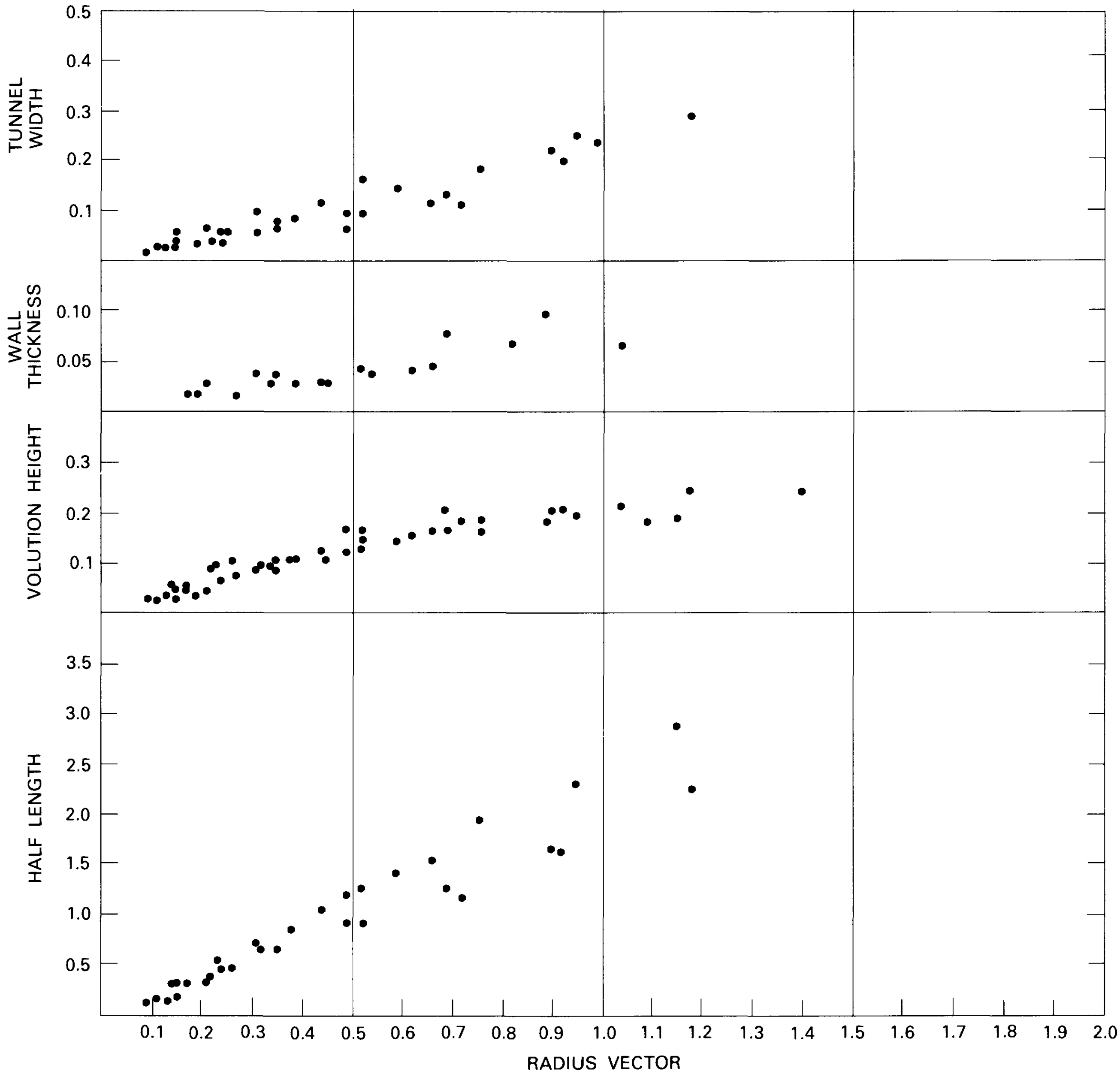


Figure 21.–Graphs for *Beedeina* sp. aff. *B. haworthi* (Beede), 1916. All measurements are in millimeters, and the values for each attribute are plotted against the radius vector.

TABLE 18.—*Measurements (in millimeters) for* Beedeina acme *(Dunbar and Henbest), 1942, and* B. *sp. aff.* B. acme *(Dunbar and Henbest), 1942*

[Leaders (____), data not available or character absent]

Character	Measurements of fossils shown in plate 14, figures 1-4, 6, 5, 7, 8, 11, 12, 9, 10											
	1	2	3	4	6	5	7	8	11	12	9	10
Diameter of proloculus	0.16	0.16	0.12	0.14	0.19	0.16	0.16	0.19	0.21	0.15	0.19	____
Radius vector												
1	0.12	0.15	0.08	0.12	0.12	0.12	0.11	0.11	0.11	0.10	0.16	0.8
2	.17	.23	.12	.19	.17	.18	.14	.16	.16	.18	.25	.13
3	.23	.34	.26	.28	.24	.27	.20	.25	.26	.26	.36	.21
4	.32	.50	.38	.42	.34	.36	.28	.33	.41	.41	.48	.34
5	.43	.69	.52	.60	.50	.49	.42	.47	.59	.59	.65	.47
6	.62	.89	.74	.78	.71	.70	.58	.66	.79	.78	.90	.62
7	.84	____	.98	____	.95	1.00	____	.92	.89	.90	____	.88
Half length												
1	____	____	0.18	0.23	0.22	0.30	0.15	0.17	0.21	0.10	____	____
2	.34	____	.32	.54	.41	.52	.31	.25	.41	.26	____	____
3	.66	____	.52	1.07	.61	.70	.58	.48	.59	.37	____	____
4	.99	____	1.00	1.66	1.13	1.20	.89	.81	.80	.63	____	____
5	1.47	____	1.34	2.39	1.37	1.52	1.47	1.17	1.19	1.23	____	____
6	2.30	____	2.35	3.54	1.75	1.86	2.34	1.45	2.02	1.70	____	____
7	2.69	____	2.87	____	2.27	2.48	____	2.15	3.04	2.05	____	____
Volution height												
1	0.04	0.05	0.04	0.04	0.04	0.05	0.04	0.03	0.03	0.03	0.06	0.04
2	.05	.06	.05	.06	.06	.08	.05	.04	.05	.07	.08	.05
3	.06	.08	.08	.09	.06	.09	.06	.08	.10	.08	.11	.08
4	.08	.14	.12	.12	.10	.10	.08	.08	.14	.15	.12	.13
5	.12	.20	.14	.16	.16	.13	.12	.15	.17	.18	.19	.15
6	.20	.20	.22	.21	.20	.22	.17	.19	.21	.20	.25	.25
7	.23	____	.24	____	.24	.30	____	.26	.17	.13	____	____
Wall thickness												
1	____	0.02	____	0.01	____	0.02	0.03	0.02	0.02	____	0.02	____
2	____	.02	____	.02	.02	.03	.03	.04	.02	.02	.03	.01
3	.01	.03	.015	.03	.025	.05	.02	.06	____	.02	.03	.02
4	.02	.04	.02	.03	.03	.04	.02	.03	.03	.02	.04	.03
5	.04	.06	.03	.03	.03	.04	.02	.03	.02	.03	.07	.04
6	.05	.07	.02	____	.02	.04	.01	.04	.04	.03	.08	.06
7	.03	____	.03	____	.03	.04	____	.04	.02	.02	____	____
Tunnel width (axials) or septal spacing												
1	0.01	0.02	0.02	0.04	0.04	0.06	0.05	0.04	0.02	0.03	0.03	0.02
2	.06	.04	.04	.06	.05	.10	.10	.07	.03	.04	0.3	.03
3	.04	.05	.05	.11	.07	.03	.14	.11	.05	.05	.03	.03
4	.12	.05	.10	.12	.10	.06	.18	____	.08	____	.04	.04
5	.20	.04	.12	____	.12	.10	____	____	.14	____	.05	.05
6	.29	____	.20	____	.22	____	____	____	____	____	____	.06

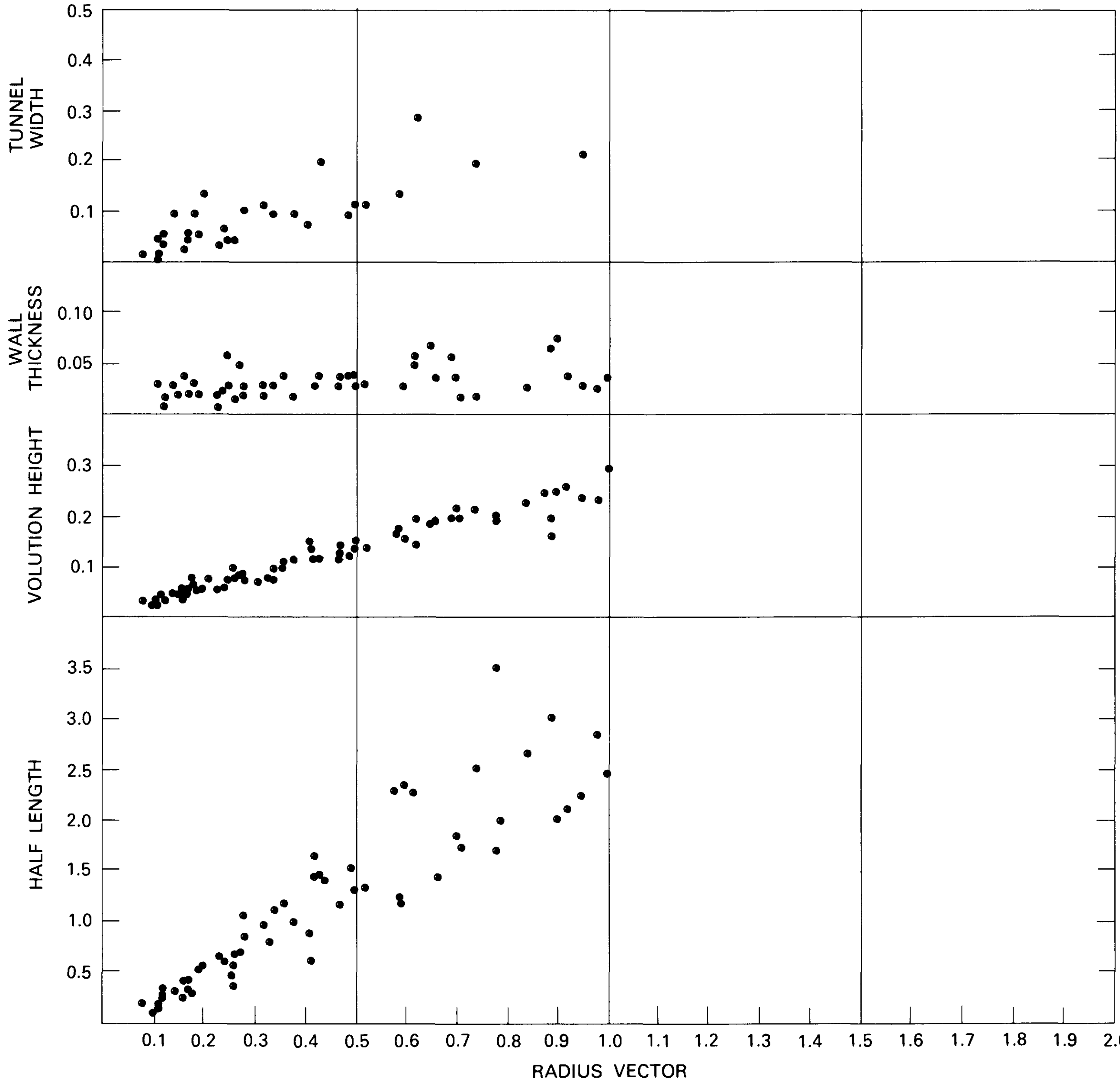


Figure 22. – Graphs for *Beedeina acme* (Dunbar and Henbest), 1942. All measurements are in millimeters, and the values for each attribute are plotted against the radius vector.

TABLE 19.—*Measurements (in millimeters) for* Beedeina carmani *(Thompson), 1936*

[Leaders (____), data not available or character absent]

Character	Measurements of fossils shown in plate 15, figures 1-6					
	1	2	3	4	5	6
Diameter of proloculus	0.19	0.20	0.12	0.12	0.12	0.16
Radius vector						
1	0.14	0.11	0.12	0.12	0.12	0.13
2	.23	.185	.19	.205	.18	.205
3	.38	.28	.29	.305	.25	.29
4	.515	.42	.43	.46	.38	.41
5	.69	.62	.58	.65	.515	.57
6	----	----	----	----	----	----
7	----	----	----	----	----	----
Half length						
1	0.27	0.16	----	----	0.21	0.26
2	.55	.33	----	----	.45	.42
3	.88	.82	----	----	.62	.68
4	1.31	1.19	----	----	.92	.99
5	1.95	1.78	----	----	1.35	1.24
6	----	----	----	----	----	1.78
7	----	----	----	----	----	----
Volution height						
1	0.055	0.02	0.03	0.04	0.04	0.04
2	.09	.06	.07	.08	.05	.07
3	.135	.10	.09	.10	.06	.09
4	.15	.14	.14	.15	.12	.12
5	.175	.20	.15	.19	.13	.15
6	----	----	----	----	----	----
7	----	----	----	----	----	----
Wall thickness						
1	----	----	----	----	----	----
2	----	0.025	0.01	0.02	----	0.015
3	.04	.025	.015	.05	----	----
4	----	.06	.03	.04	----	.05
5	.07	----	.05	.08	----	.08
6	----	----	----	----	----	----
Tunnel width (axials) or septal spacing						
1	0.055	0.04	0.03	0.02	0.06	0.045
2	.09	.06	.04	.04	.07	.07
3	.14	.12	.05	.04	.11	.12
4	.18	.215	.05	.04	.12	.15
5	.32	----	.05	.04	.18	.32
6	----	----	----	----	----	----

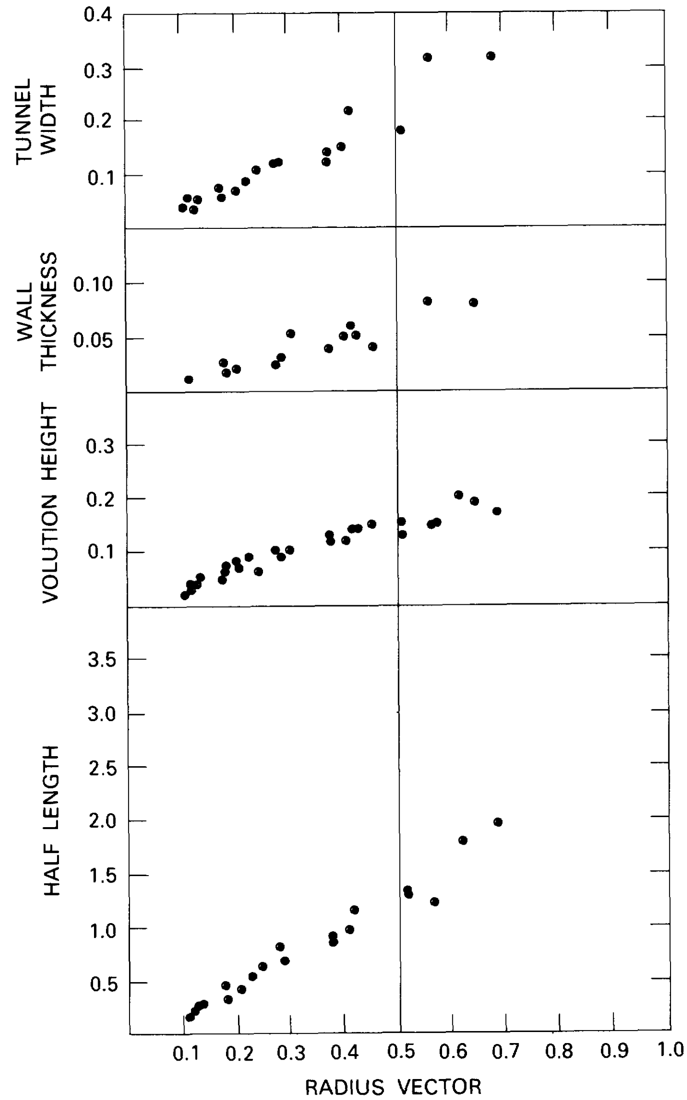


Figure 23.—Graphs for *Beedeina carmani* (Thompson), 1936. All measurments are in millimeters, and the values for each attribute are plotted against the radius vector.

TABLE 20.—*Measurements (in millimeters) for* Beedeina *sp.*

[Leaders (____), data not available or character absent]

Character	Measurements of fossils shown in plate 17, figures 16–19, 21, 22, 5, 6							
	16	17	18	19	21	22	5	6
Diameter of proloculus	0.10	0.10	0.10	0.09	0.12	0.13	0.10	0.105
Radius vector								
1	0.095	0.09	0.10	0.11	0.10	0.12	0.10	0.115
2	.16	.16	.15	.15	.165	.19	.16	.225
3	.25	.26	.21	.27	.27	.27	.225	.32
4	____	____	.345	____	____	.41	.34	____
5	____	____	.51	____	____	____	____	____
6	____	____	____	____	____	____	____	____
Half length								
1	0.12	0.125	0.13	0.17	0.143	0.12	0.13	0.19
2	.24	.21	.25	.38	.23	.23	.24	.34
3	.40	.37	.51	.68	.39	.43	.38	.61
4	____	____	.87	____	____	.525	.51	____
5	____	____	____	____	____	____	____	____
Volution height								
1	0.03	0.03	0.02	0.04	0.03	0.05	0.04	0.04
2	.07	.07	.04	.05	.06	.06	.06	.10
3	.09	.10	.06	.12	.10	.09	.07	.10
4	____	____	.13	____	____	.13	.115	____
5	____	____	.16	____	____	____	____	____
6	____	____	____	____	____	____	____	____
Wall thickness								
1	____	____	____	0.025	0.02	____	____	____
2	.02	____	____	.025	.03	____	.01	____
3	____	____	.04	.06	.03	____	.025	____
4	____	____	____	____	____	____	____	____
5	____	____	.06	____	____	____	____	____
6	____	____	____	____	____	____	____	____
Tunnel width (axials) or septal spacing								
1	0.03	0.028	____	0.045	0.03	0.05	0.02	0.02
2	.06	.04	.04	.06	.06	.07	.04	.05
3	.10	.09	.07	.09	.08	.10	.07	.09
4	____	____	.11	____	____	.14	____	____
5	____	____	.20	____	____	.14	____	____

TABLE 21.–*Measurements (in millimeters) for* Triticites skinneri *Thompson, 1936*

[Leaders (----), data not available or character absent]

Character	Measurements of fossils shown in plate 16, figures 1–10									
	1	2	3	4	5	6	7	8	9	10
Diameter of proloculus	0.06	0.06	0.05	0.045	0.03	0.06	0.07	0.06	0.05	----
Radius vector										
1	0.07	0.10	0.07	0.07	0.06	0.07	0.10	0.10	0.08	----
2	.13	.17	.125	.12	.10	.11	.16	.14	.12	.13
3	.21	.28	.21	.18	.17	.17	.26	.23	.20	.21
4	.29	.43	.23	.31	.25	.24	.42	.37	.30	.32
5	.42	.63	.33	.49	.38	.34	.63	.58	.44	.52
6	.62	----	.50	.73	.53	.50	.89	.82	.68	.78
7	----	----	.69	1.00	----	.73	----	1.09	.91	1.03
Half length										
1	0.13	0.17	0.11	----	----	----	0.13	0.15	0.9	----
2	.29	.29	.28	----	----	----	.31	.34	.21	----
3	.51	.49	.45	----	----	----	.73	.50	.435	----
4	.82	.99	.73	----	----	----	1.23	.83	.77	----
5	1.25	1.47	.95	----	----	----	2.03	1.19	1.24	----
6	1.90	----	1.18	----	----	----	2.54	1.76	1.76	----
7	----	----	1.61	----	----	----	----	2.45	2.15	----
Volution height										
1	0.02	0.02	0.015	0.02	0.02	0.15	0.04	0.04	0.02	----
2	.05	.07	.05	.04	.03	.04	.05	.05	.04	----
3	.09	.11	.08	.06	.06	.06	.11	.09	.07	.06
4	.07	.17	.12	.14	.08	.07	.16	.14	.10	.10
5	.14	.20	.17	.18	.12	.10	.20	.21	.14	.20
6	.17	----	.20	.24	.14	.16	.27	.23	.23	.25
7	----	----	.21	.26	----	.23	----	.27	.23	.25
Wall thickness										
1	----	----	----	----	----	----	----	----	----	
2	----	----	0.015	----	----	----	----	----	----	0.015
3	----	.03	.025	.005	.018	.015	----	----	----	.02
4	----	.04	----	.03	.03	.02	.025	.08	----	.035
5	----	----	----	.035	.04	.05	----	----	----	.05
6	----	----	----	.03	----	----	----	----	----	.06
7	----	----	----	----	----	----	.06	----	----	----
Tunnel width (axials) or septal spacing										
1	0.02	0.02	0.02	0.02	0.025	0.01	----	0.04	----	----
2	.04	.04	.05	.03	.03	.025	----	.08	.06	----
3	.07	.07	.08	.04	.04	.03	.07	.13	.10	.04
4	.11	.12	.11	.04	.05	.04	.08	.23	.10	.05
5	.18	.18	.13	.05	.05	.05	.16	----	----	.06
6	----	----	----	.05	----	.09	.20	----	----	.065
7	----	----	----	.06	----	----	----	----	----	.06

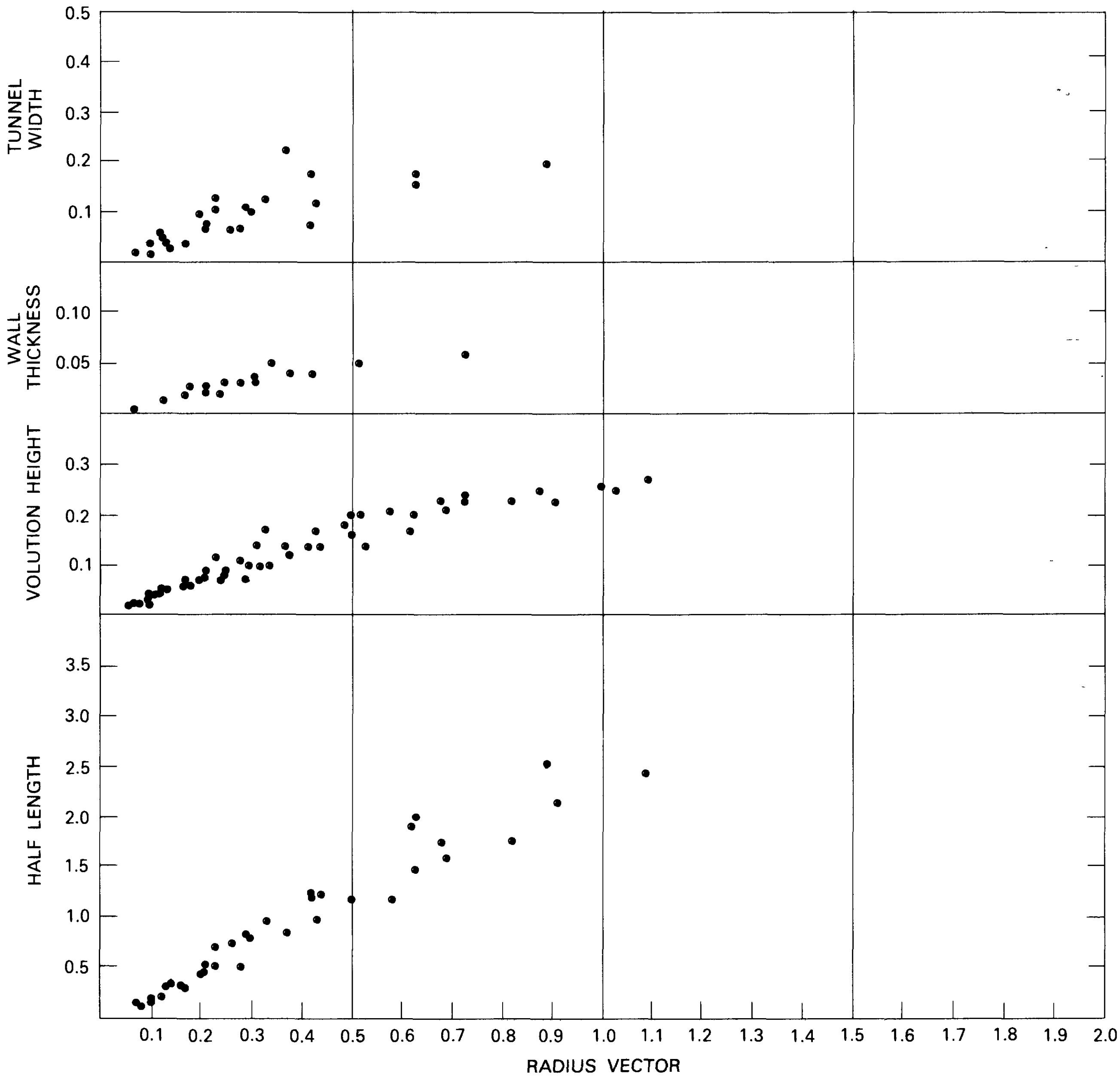


Figure 24.–Graphs for *Triticites skinneri* Thompson, 1936. All measurements are in millimeters, and the values for each attribute are plotted against the radius vector.

TABLE 22.–*Measurements (in millimeters) for* Triticites ricei *Douglass n. sp.*

[Leaders (____), data not available or character absent]

Character	Measurements of fossils shown in plate 16, figures 11–18							
	11	12	13	14	15	16	17	18
Diameter of proloculus	0.12	0.21	0.11	0.08	0.16	0.09	0.10	0.08
Radius vector								
1	0.13	0.14	0.15	0.11	0.12	0.10	0.11	0.095
2	.19	.20	.21	.18	.18	.15	.17	.14
3	.28	.29	.31	.28	.26	.22	.26	.20
4	.42	.41	.47	.42	.37	.34	.38	.31
5	.58	.57	.64	.58	.57	.51	.58	.43
6	.76	.71	.86	.79	----	.68	.78	----
7	.94	.93	1.08	----	----	----	----	
8	1.13	1.10	----	----	----	----	----	----
Half length								
1	0.30	0.32	----	----	0.31	0.18	----	----
2	.52	.46	----	----	.56	.36	----	----
3	.97	.69	----	----	.89	.66	----	----
4	1.33	.98	----	----	1.41	.99	----	----
5	1.72	1.34	----	----	1.82	1.50	----	----
6	2.16	1.75	----	----	----	1.79	----	----
7	2.60	2.21	----	----	----	----	----	----
8	3.18	2.73	----	----	----	----	----	----
Volution height								
1	0.05	0.03	0.05	0.04	0.04	0.03	0.04	0.03
2	.07	.06	.06	.05	.06	.05	.06	.05
3	.09	.09	.10	.10	.08	.07	.09	.06
4	.13	.12	.16	.13	.11	.12	.12	.10
5	.16	.15	.17	.16	.19	.16	.19	.12
6	.18	.15	.22	.21	----	.17	.21	----
7	.18	.20	.23	----	----	----	----	----
8	.18	.17	----	----	----	----	----	----
Wall thickness								
1	----	----	----	0.02	----	----	----	----
2	.015	----	.01	.02	----	----	.02	----
3	.03	.03	.01	.04	----	.02	----	----
4	----	.08	.04	.04	.04	.04	.04	.04
5	----	----	.05	.04	----	----	.055	----
6	----	----	.05	----	----	----	----	----
Tunnel width (axials) or septal spacing								
1	----	----	0.02	0.02	----	0.02	0.02	0.02
2	0.07	----	.03	.02	.06	.04	.03	.03
3	.12	.10	.04	.04	.10	.08	.05	.04
4	.24	.13	.06	.04	.12	.12	.07	.05
5	.31	.23	.065	.04	.21	.27	.07	.06
6	----	.34	.07	----	----	----	----	----
7	----	.42	.06	----	----	----	----	----

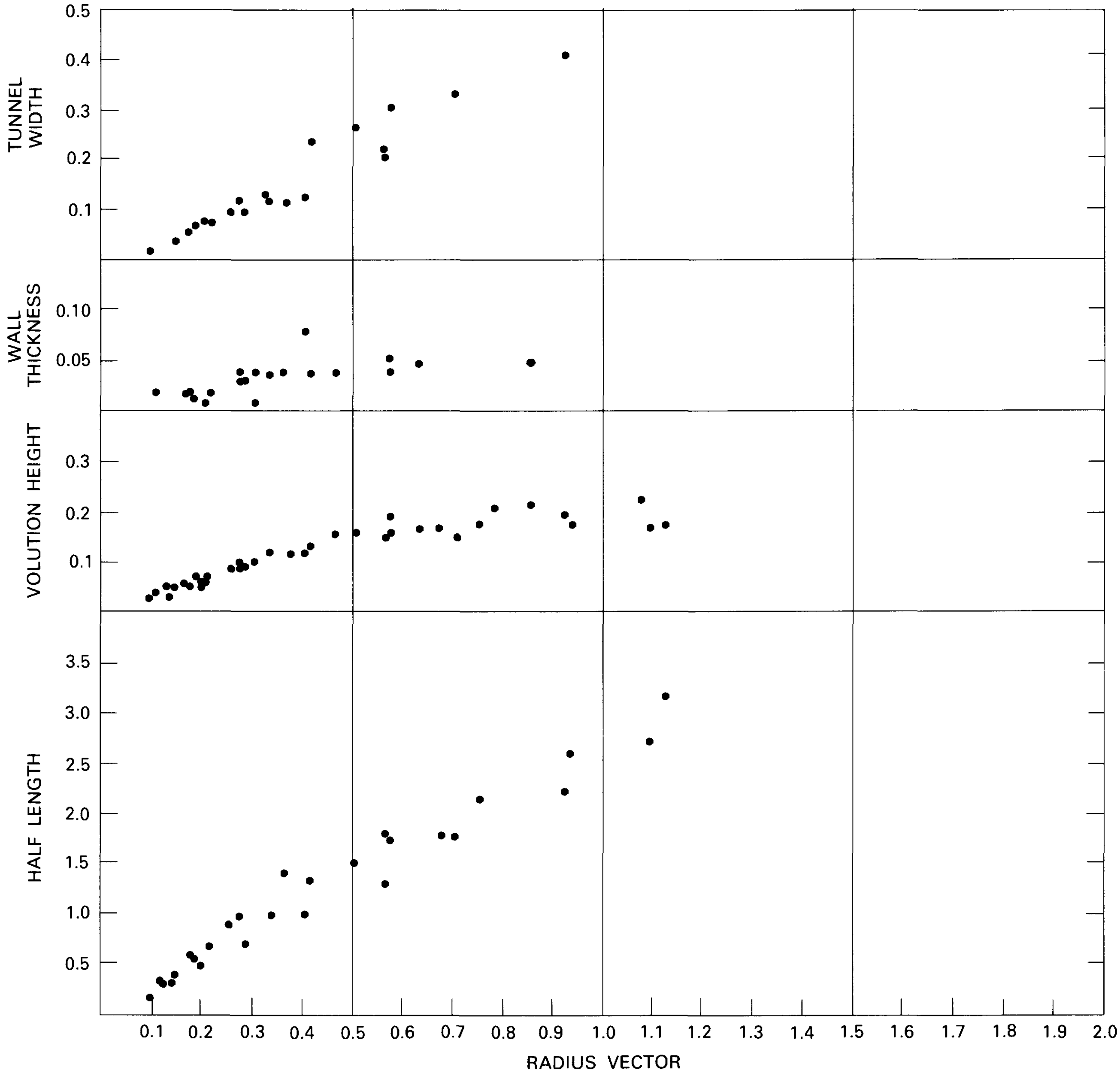


Figure 25.–Graphs for *Triticites ricei* Douglass n. sp. All measurements are in millimeters, and the values for each attribute are plotted against the radius vector.

TABLE 23.—*Measurements (in millimeters) for* Triticites ohioensis *Thompson, 1936*

[Leaders (____), data not available or character absent]

Character	Measurements of fossils shown in plate 16, figures 21–24			
	21	22	23	24
Diameter of proloculus	0.13	0.12	0.11	0.10
Radius vector				
1	0.10	0.10	0.09	0.09
2	.16	.16	.14	.14
3	.30	.26	.19	.21
4	.50	.42	.30	.32
5	.68	.64	.47	.47
6	.94	.89	.68	.70
7	____	1.17	.89	.92
8	____	____	____	____
Half length				
1	0.16	0.14	____	____
2	.34	.30	____	____
3	.73	.57	____	____
4	1.31	.96	____	____
5	2.16	1.64	____	____
6	3.33	2.49	____	____
7	____	3.38	____	____
Volution height				
1	0.03	0.025	0.01	0.02
2	.06	.06	.04	.04
3	.14	.10	.05	.07
4	.20	.16	.10	.11
5	.19	.22	.16	.15
6	.26	.25	.20	.22
7	____	.29	.21	.23
8	____	____	____	____
Wall thickness				
1	____	____	0.02	.02
2	____	____	.02	.04
3	.02	.03	.04	.06
4	____	.07	.04	.05
5	.04	.12	.04	.06
6	____	____	.06	.05
7	____	____	____	____
8	____	____	____	____
Tunnel width (axials) or septal spacing				
1	0.04	0.03	0.03	____
2	.07	.05	.03	.02
3	.11	.09	.04	.02
4	.21	.20	.05	.04
5	.48	.34	.05	.04
6	____	.65	.04	____
7	____	____	____	____
8	____	____	____	____

TABLE 23.—*Measurements (in millimeters) for* Triticites ohioensis *Thompson, 1936*—Continued

Character	Measurements of fossils shown in plate 18, figures 1-9								
	1	2	3	4	5	6	7	8	9
Diameter of proloculus	0.10	0.10	0.10	0.09	0.13	0.09	0.075	0.065	0.060
Radius vector									
1	0.07	0.09	0.10	0.11	0.11	0.09	0.065	0.06	0.065
2	.15	.15	.15	.17	.16	.15	.11	.10	.11
3	.25	.23	.24	.28	.25	.19	.18	.16	.18
4	.41	.37	.38	.40	.42	.30	.27	.25	.27
5	.60	.62	.54	.60	.64	.45	.40	.38	.39
6	.88	.84	.75	.85	.85	.70	.58	.53	.61
7	1.10	1.15	.98	1.08	1.07	1.02	.83	.75	.83
8	----	----	----	----	----	1.26	1.05	----	----
Half length									
1	0.11	0.15	----	----	0.24	----	0.09	0.12	0.14
2	.34	.31	----	----	.41	----	.21	.25	.29
3	.56	.84	----	----	.77	----	.37	.43	.48
4	.89	1.04	----	----	1.24	----	.61	.64	.86
5	1.75	1.79	----	----	1.75	----	1.00	1.07	1.53
6	3.09	2.89	----	----	2.24	----	1.90	1.89	2.64
7	3.96	3.91	----	----	3.16	----	2.70	2.92	3.50
Volution height									
1	0.04	0.04	0.02	0.03	0.04	0.02	0.03	0.35	0.04
2	.07	.06	.04	.06	.05	.05	.035	.04	.05
3	.10	.08	.09	.10	.08	.05	.06	.05	.07
4	.16	.14	.14	.12	.16	.10	.10	.09	.09
5	.19	.25	.15	.20	.22	.15	.12	.13	.14
6	.27	.22	.21	.24	.20	.25	.19	.15	.19
7	.21	.30	.23	.24	.23	.33	.24	.23	.22
8	----	----	----	----	----	.24	----	----	----
Wall thickness									
1	----	----	0.01	----	----	----	----	----	.015
2	.02	----	----	.01	.02	.02	----	.02	.02
3	----	----	.04	.02	----	.02	----	.02	.025
4	----	----	----	.03	----	.04	.02	.03	.02
5	.08	----	----	.04	.04	.06	.04	.04	.05
6	----	----	.04	0.5	.07	.08	.06	.05	.05
7	----	----	----	.07	----	----	.08	.045	.05
8	----	----	----	----	----	----	.05	.05	----
Tunnel width (axials) or septal spacing									
1	0.03	0.03	0.05	0.03	0.02	0.02	----	0.045	0.04
2	.04	.06	.05	.04	.04	.03	.02	.065	.06
3	.08	.07	.08	.04	.05	.05	.04	.09	.14
4	.13	.10	.12	.05	----	.07	.05	.15	.26
5	.23	.19	.28	.08	.17	.08	.16	.34	.55
6	.41	----	.32	.04	.37	.06	.38	.63	.93
7	----	----	----	----	----	.07	.79	1.12	----
8	----	----	----	----	----	----	----	----	----

TABLE 23.—*Measurements (in millimeters) for* Triticites ohioensis *Thompson, 1936*—Continued

Character	Measurements of fossils shown in plate 18, figures 10–18								
	10	11	12	13	14	15	16	17	18
Diameter of proloculus	0.06	0.06	0.06	0.06	0.05	0.08	0.10	0.09	0.09
Radius vector									
1	0.065	0.055	0.09	0.07	0.055	0.07	0.11	0.10	0.08
2	.13	.10	.15	.18	.095	.13	.16	.17	.15
3	.19	.155	.26	.25	.145	.22	.26	.27	.22
4	.29	.23	.38	.28	.25	.34	.41	.42	.34
5	.47	.38	.56	.40	.39	.54	.62	.62	.48
6	.60	.57	.78	.59	.55	.75	.85	.84	.68
7	.87	.87	1.03	.82	.76	.99	1.09	----	.88
8	----	.93	----	.92	.81	----	----	----	----
Half length									
1	0.08	----	----	----	----	----	0.17	0.20	0.13
2	.19	----	----	----	----	----	.34	.39	.25
3	.31	----	----	----	----	----	.67	.68	.45
4	.56	----	----	----	----	----	1.02	1.19	.75
5	.89	----	----	----	----	----	2.21	1.99	1.33
6	1.52	----	----	----	----	----	2.87	2.66	2.18
7	----	----	----	----	----	----	3.71	----	2.95
Volution height									
1	0.03	0.025	0.055	0.05	0.03	0.02	0.04	0.04	0.02
2	.06	.04	.06	.055	.04	.04	.05	.08	.07
3	.06	.05	.10	.06	.07	.09	.10	.10	.08
4	.09	.08	.12	.09	.08	.12	.15	.15	.12
5	.14	.14	.15	.12	.13	.20	.21	.20	.14
6	.18	.19	.22	.19	.17	.20	.22	.23	.21
7	.22	.25	.25	.22	.21	.24	.25	----	.21
8	----	----	----	----	----	----	----	----	----
Wall thickness									
1	----	----	----	----	----	0.01	----	----	----
2	.03	.015	.025	.02	.01	.02	----	----	.02
3	.025	.015	.03	.03	.02	.025	----	.02	.03
4	.03	.03	.025	.03	.025	.04	.03	----	----
5	.04	.04	.045	.03	.025	.05	----	.04	.03
6	.05	.06	.055	.06	.04	.05	----	----	----
7	.06	.05	.05	.06	.04	----	----	----	----
8	----	.05	----	----	.04	----	----	----	----
Tunnel width (axials) or septal spacing									
1	----	----	----	0.03	0.03	0.03	0.02	0.02	0.03
2	.04	.045	.06	.045	.04	.03	.05	.03	.05
3	.05	.055	.07	.06	.08	.04	.10	.06	.08
4	.13	.065	.13	.08	.07	.08	.18	.10	.13
5	.32	.105	.15	.10	.115	.05	----	.18	.21
6	.54	.14	.30	.13	.17	.06	----	----	----
7	----	.18	----	.16	.20	----	----	----	----
8	----	.34	----	----	.20	----	----	----	----

TABLE 23.–*Measurements (in millimeters) for* Triticites ohioensis *Thompson, 1936*–Continued

Character	Measurements of fossils shown in plate 18, figures 19–27								
	19	20	21	22	23	24	25	26	27
Diameter of proloculus	0.12	0.10	0.08	0.06	0.08	0.07	0.06	0.08	0.09
Radius vector									
1	0.12	0.09	0.08	0.10	0.08	0.08	0.10	0.08	0.12
2	.21	.17	.13	.17	.13	.13	.14	.14	.18
3	.31	.27	.20	.26	.20	.19	.21	.19	.24
4	.46	.40	.31	.39	.45	.31	.32	.30	.35
5	.62	.58	.45	.56	.62	.44	.45	.60	.46
6	.85	.77	.65	.77	----	.66	.66	.78	.62
7	1.03	----	.89	1.00	----	.85	----	----	----
8	----	----	1.05	----	----	----	----	----	----
Half length									
1	0.22	0.17	----	----	----	0.10	----	----	----
2	.47	.33	----	----	----	24	----	----	----
3	.83	.70	----	----	----	.45	----	----	----
4	1.46	1.12	----	----	----	1.02	----	----	----
5	2.38	1.91	----	----	----	1.89	----	----	----
6	3.08	2.76	----	----	----	2.38	----	----	----
7	----	----	----	----	----	2.72	----	----	----
Volution height									
1	0.05	0.03	0.02	0.03	0.02	0.03	0.03	0.03	0.04
2	.08	.08	.05	.07	.05	.05	.04	.06	.05
3	.10	.10	.07	.09	.07	.06	.07	.06	.07
4	.15	.14	.11	.12	.08	.11	.10	.11	.11
5	.17	.17	.13	.17	.17	.14	.14	.14	.12
6	.22	.20	.21	.21	.11	.21	.20	.16	.15
7	.20	----	.23	.23	----	.19	----	.18	----
8	----	----	.16	----	----	----	----	----	----
Wall thickness									
1	----	----	----	----	0.02	----	----	----	0.01
2	----	----	.02	.018	----	----	----	----	.02
3	.04	.03	.02	.02	----	.03	.015	----	.02
4	----	.03	.03	.025	.09	----	.02	.02	.035
5	.09	.04	.03	.04	----	----	.02	.025	.04
6	----	.05	..07	.07	----	----	.08	.06	----
7	----	.06	.07	.08	----	----	.08	.06	----
8	----	----	----	----	----	----	----	----	----
Tunnel width (axials) or septal spacing									
1	0.04	.03	0.02	0.02	0.04	----	0.02	0.02	0.02
2	.07	.04	.025	.03	.08	.03	.05	.02	.03
3	.11	.04	.04	.05	.12	.04	.04	.03	.05
4	----	.08	.04	.06	.28	.12	.06	.035	.04
5	----	.16	.05	.06	----	.19	.05	.06	.04
6	----	.23	.08	.04	----	----	.05	.04	.05
7	----	.33	.05	.04	----	----	----	.05	----
8	----	----	----	----	----	----	----	----	----

TABLE 23.—*Measurements (in millimeters) for* Triticites ohioensis *Thompson, 1936*—Continued

Character	Measurements of fossils shown in plate 18, figures 28–36								
	28	29	30	31	32	33	34	35	36
Diameter of proloculus	0.09	0.08	0.08	0.09	0.11	0.09	0.07	0.14	0.08
Radius vector									
1	0.09	0.08	0.10	0.08	0.08	0.11	0.10	0.12	0.09
2	.14	.15	.16	.14	.13	.16	.17	.18	.15
3	.22	.24	.24	.22	.20	.23	.26	.26	.24
4	.54	.37	.34	.34	.32	.37	.41	.37	.39
5	----	.57	.46	.47	.45	.52	.59	.53	.55
6	----	----	.62	----	.64	.70	.79	.75	.77
7	----	----	----	----	----	----	----	----	----
8	----	----	----	----	----	----	----	----	----
Half length									
1	0.12	0.12	----	0.14	0.20	0.16	0.14	0.26	0.10
2	.33	.25	----	.30	.40	.31	.25	.48	.24
3	.50	.42	----	.42	.86	.67	.37	.86	.44
4	.90	.72	----	.82	1.12	1.34	.63	1.44	.77
5	2.25	1.25	----	1.32	1.68	2.08	1.25	1.97	1.28
6	2.92	2.08	----	2.07	2.45	3.07	1.81	2.68	2.16
7	----	----	----	----	----	----	2.31	----	2.86
Volution height									
1	0.02	0.03	0.04	0.01	0.02	0.04	0.04	0.04	0.03
2	.05	.07	.05	.03	.04	.04	.07	.06	.06
3	.08	.08	.08	.05	.07	.08	.09	.08	.09
4	.10	.14	.10	.08	.12	.13	.15	.11	.16
5	.22	.20	.12	.12	.12	.16	.18	.16	.19
6	----	----	.16	.13	.20	.18	.20	.21	.20
7	----	----	----	----	----	----	----	----	----
8	----	----	----	----	----	----	----	----	----
Wall thickness									
1	----	----	----	----	----	----	----	----	----
2	----	0.02	0.01	----	----	.01	----	----	----
3	----	.05	.01	----	.04	----	.02	----	.03
4	.04	.07	.01	----	----	.05	.03	----	----
5	----	----	.04	----	----	.06	.04	----	----
6	----	----	.05	----	----	----	----	----	----
7	----	----	----	----	----	----	----	----	----
8	----	----	----	----	----	----	----	----	----
Tunnel width (axials) or septal spacing									
1	----	0.04	0.02	----	----	0.03	0.035	0.02	0.02
2	.04	.06	0.3	----	.05	.05	.04	.04	.06
3	.07	.11	.04	.11	.10	----	.06	.065	.11
4	.14	.20	.05	.15	.17	.11	.09	.14	.21
5	----	----	.04	----	----	----	----	.17	.32
6	----	----	.04	----	----	----	----	.22	----
7	----	----	----	----	----	----	----	----	----
8	----	----	----	----	----	----	----	----	----

TABLE 23.—*Measurements (in millimeters) for* Triticites ohioensis *Thompson, 1936*—Continued

Character	Measurements of fossils shown in plate 18, figures 37–45								
	37	38	39	40	41	42	43	44	45
Diameter of proloculus	0.07	0.07	0.06	0.155	0.14	0.12	0.15	0.08	0.10
Radius vector									
1	0.09	0.075	0.08	0.10	0.11	0.12	0.12	0.09	0.11
2	.13	.15	.14	.16	.19	.20	.20	.15	.18
3	.20	.36	.20	.25	.36	.32	.31	.23	.28
4	.29	.55	.48	.40	.57	.45	.47	.34	.46
5	.44	----	.67	.59	----	----	.675	.50	.66
6	.63	----	----	----	----	----	----	.69	----
7	----	----	----	----	----	----	----	.91	----
8	----	----	----	----	----	----	----	----	----
Half length									
1	----	----	----	0.28	0.28	0.23	0.33	----	----
2	----	----	----	.43	.60	.51	.62	----	----
3	----	----	----	1.05	1.63	1.06	1.03	----	----
4	----	----	----	1.56	2.38	1.66	1.87	----	----
5	----	----	----	2.32	----	----	2.27	----	----
6	----	----	----	----	----	----	----	----	----
7	----	----	----	----	----	----	----	----	----
Volution height									
1	0.03	0.04	0.03	0.03	0.05	0.06	0.05	0.03	0.05
2	.04	.07	.06	.07	.08	.08	.07	.06	.07
3	.06	.08	.06	.08	.16	.12	.11	.08	.11
4	.07	.11	.11	.15	.21	.13	.16	.11	.17
5	.15	.18	.16	.19	----	----	.205	.16	.21
6	.19	----	.19	----	----	----	----	.21	----
7	----	----	----	----	----	----	----	----	----
8	----	----	----	----	----	----	----	----	----
Wall thickness									
1	----	----	----	----	----	----	----	----	----
2	0.01	0.015	0.01	----	0.03	----	----	----	0.01
3	.01	.015	.02	.06	.06	.05	.04	----	.015
4	.02	.035	.025	.115	----	----	.06	.025	.025
5	.04	.05	.03	----	----	----	.045	.05	----
6	.05	----	----	----	----	----	.06	----	----
7	----	----	----	----	----	----	.065	----	----
8	----	----	----	----	----	----	----	----	----
Tunnel width (axials) or septal spacing									
1	0.02	0.03	0.02	----	0.05	0.045	0.02	0.025	0.02
2	.03	.04	.03	.07	.08	.08	.07	.025	.02
3	.04	.06	.04	.12	.14	.14	.15	.04	.04
4	.05	.06	.05	.24	----	----	.25	.045	.05
5	.07	.09	.06	----	----	----	----	.06	.03
6	.07	----	.06	----	----	----	----	.05	----
7	----	----	----	----	----	----	----	.05	----
8	----	----	----	----	----	----	----	----	----

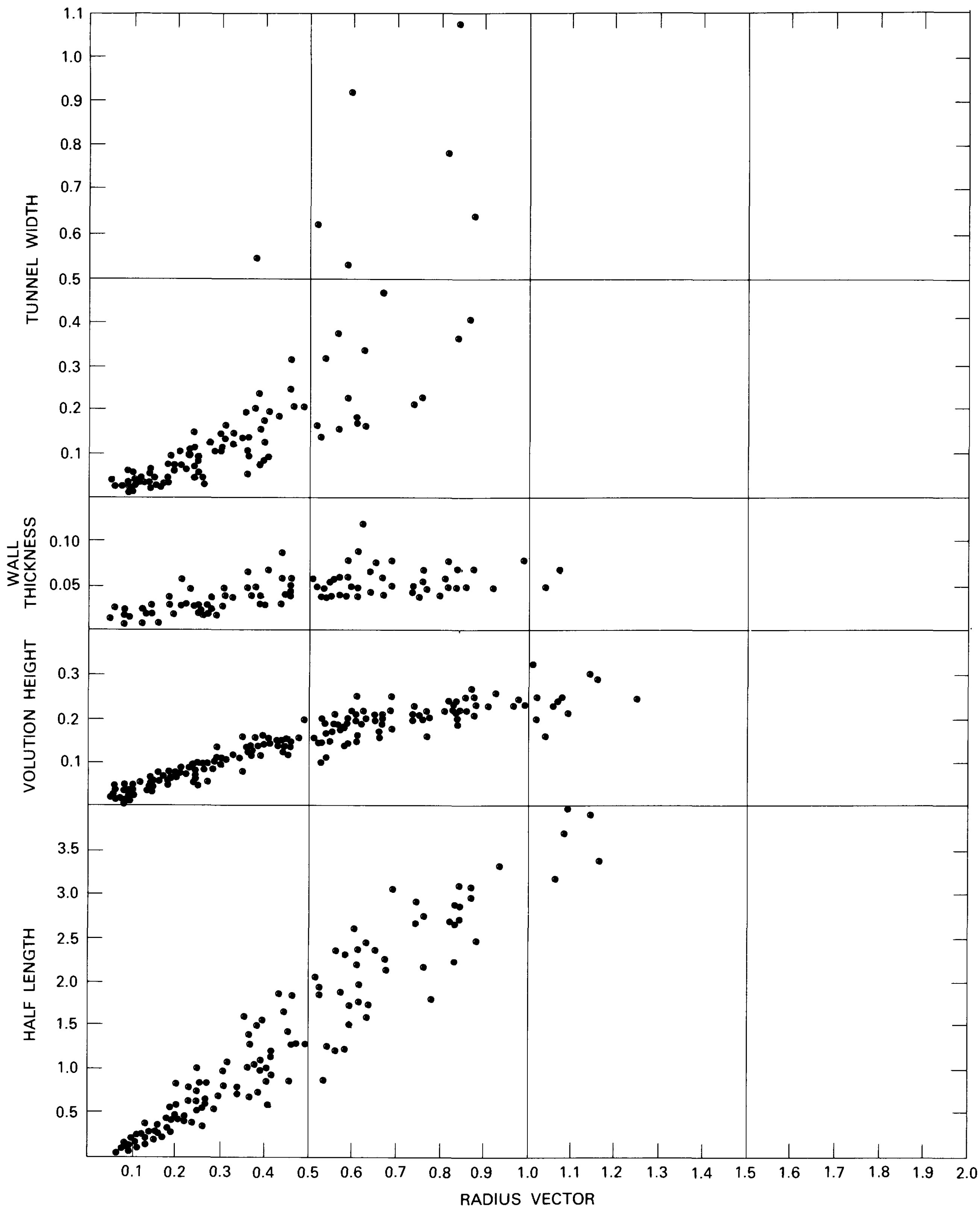


Figure 26. – Graphs for *Triticites ohioensis* Thompson, 1936. All measurements are in millimeters, and the values for each attribute are plotted against the radius vector.

TABLE 24.—*Measurements (in millimeters) for* Triticites smythi *Douglass n. sp.*

[Leaders (____), data not available or character absent]

Character	Measurements of fossils shown in plate 16, figures 25-28			
	25	26	27	28
Diameter of proloculus	0.13	0.11	0.11	0.13
Radius vector				
1	0.12	0.09	0.11	0.13
2	.17	.15	.15	.19
3	.26	.24	.22	.29
4	.37	.38	.33	.41
5	.53	.54	.45	____
Half length				
1	0.19	0.20	____	____
2	.36	.32	____	____
3	.59	.56	____	____
4	.81	1.01	____	____
5	1.22	1.43	____	____
Volution height				
1	0.04	0.03	0.03	0.03
2	.06	.05	.04	.07
3	.08	.09	.07	.10
4	.11	.14	.10	.12
5	.16	.16	.13	____
Wall thickness				
1	____	0.03	____	____
2	____	.05	____	.025
3	.05	.10	.01	.028
4	____	.17	.04	.03
5	.055	____	.05	____
Tunnel width (axials) or septal spacing				
1	0.03	0.03	0.02	0.028
2	.04	.04	.03	.04
3	.10	.08	.04	.05
4	.17	.15	.05	.07
5	.23	____	.06	____

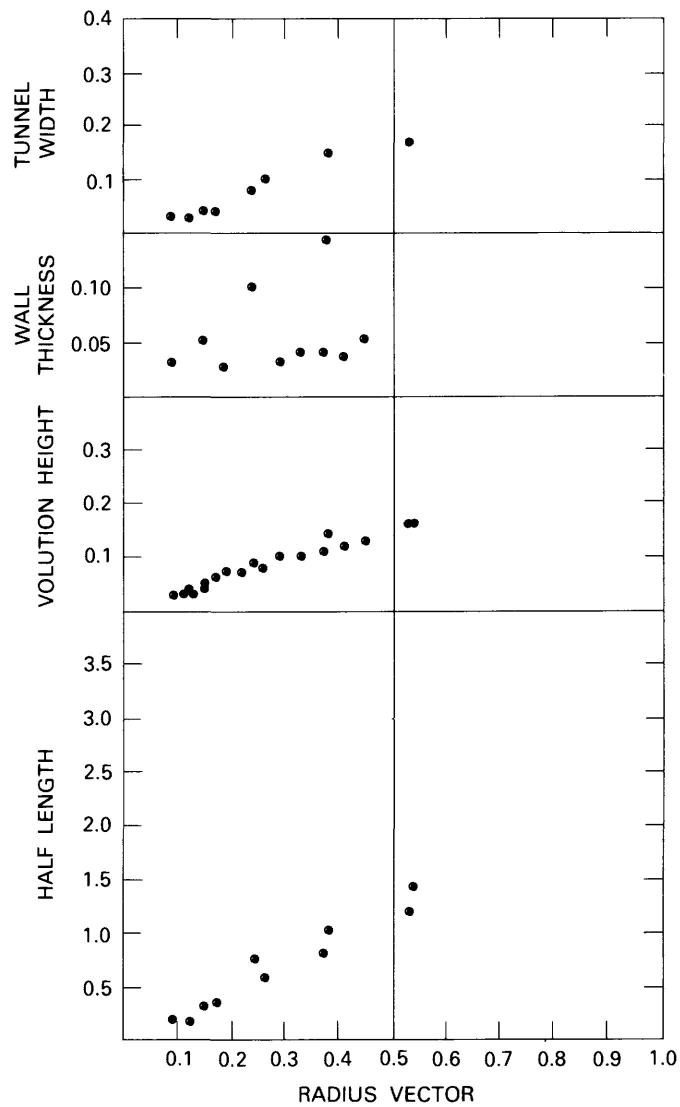


Figure 27.—Graphs for *Triticites smythi* Douglass n. sp. All measurements are in millimeters, and the values for each attribute are plotted against the radius vector.

TABLE 25.—*Measurements (in millimeters) for* Triticites kehni *Douglass n. sp.*

[Leaders (___), data not available or character absent]

Character	Measurements of fossils shown in plate 19, figures 1–8, 10								
	1	2	3	4	5	6	7	8	10
Diameter of proloculus ___	0.11	0.13	0.09	0.12	0.13	0.16	0.09	0.10	0.15
Radius vector									
1 ___	0.16	0.11	0.12	0.14	0.11	0.18	0.12	0.14	0.16
2 ___	.25	.18	.22	.25	.18	.27	.19	.23	.23
3 ___	.38	.29	.32	.33	.25	.42	.28	.31	.40
4 ___	.55	.41	.45	.47	.36	.59	.40	.52	.63
5 ___	.80	.67	.66	.68	.53	.86	.60	.75	.94
6 ___	1.14	1.01	1.00	.98	.81	1.17	.85	1.12	----
7 ___	----	----	----	----	1.17	----	1.14	----	----
Half length									
1 ___	0.21	0.21	----	0.23	0.22	----	----	0.34	0.34
2 ___	.44	.40	----	.42	.40	----	----	.66	.69
3 ___	.90	.69	----	.56	.73	----	----	1.16	1.26
4 ___	1.69	1.06	----	.83	1.13	----	----	1.65	2.37
5 ___	2.40	2.01	----	1.38	1.74	----	----	2.48	2.94
6 ___	3.58	3.49	----	1.84	3.07	----	----	3.44	----
7 ___	----	----	----	2.75	3.95	----	----	4.45	----
Volution height									
1 ___	0.09	0.03	0.04	0.05	0.03	0.03	0.06	0.05	0.05
2 ___	.09	.06	.09	.09	.06	.07	.09	.09	.07
3 ___	.12	.10	.10	.09	.07	.10	.14	.09	.16
4 ___	.16	.12	.13	.14	.12	.12	.17	.21	.22
5 ___	.25	.25	.21	.20	.16	.20	.25	----	.30
6 ___	.32	.33	.35	.30	.30	.25	.30	----	----
7 ___	----	----	----	----	.33	.28	----	----	----
Wall thickness									
1 ___	----	----	----	----	----	----	----	----	----
2 ___	.02	----	.18	----	----	.03	.01	----	----
3 ___	.02	----	.02	----	----	.03	.02	----	.05
4 ___	.05	----	.02	----	----	.02	.04	----	.07
5 ___	----	----	.04	.07	.04	.05	.045	----	----
6 ___	----	----	.07	----	.16	.06	.055	----	----
7 ___	----	----	----	----	.14	----	----	----	----
Tunnel width (axials) or septal spacing									
1 ___	0.04	----	0.02	0.04	0.04	0.02	0.02	0.03	0.06
2 ___	.07	.04	.03	.08	.08	.05	.025	.07	.08
3 ___	.08	.08	.04	.11	.13	.06	.03	.09	.15
4 ___	.17	.16	----	.22	.23	.06	.05	.16	----
5 ___	----	.31	----	----	.48	.09	.06	.17	----
6 ___	----	----	.06	----	.63	----	.06	----	----

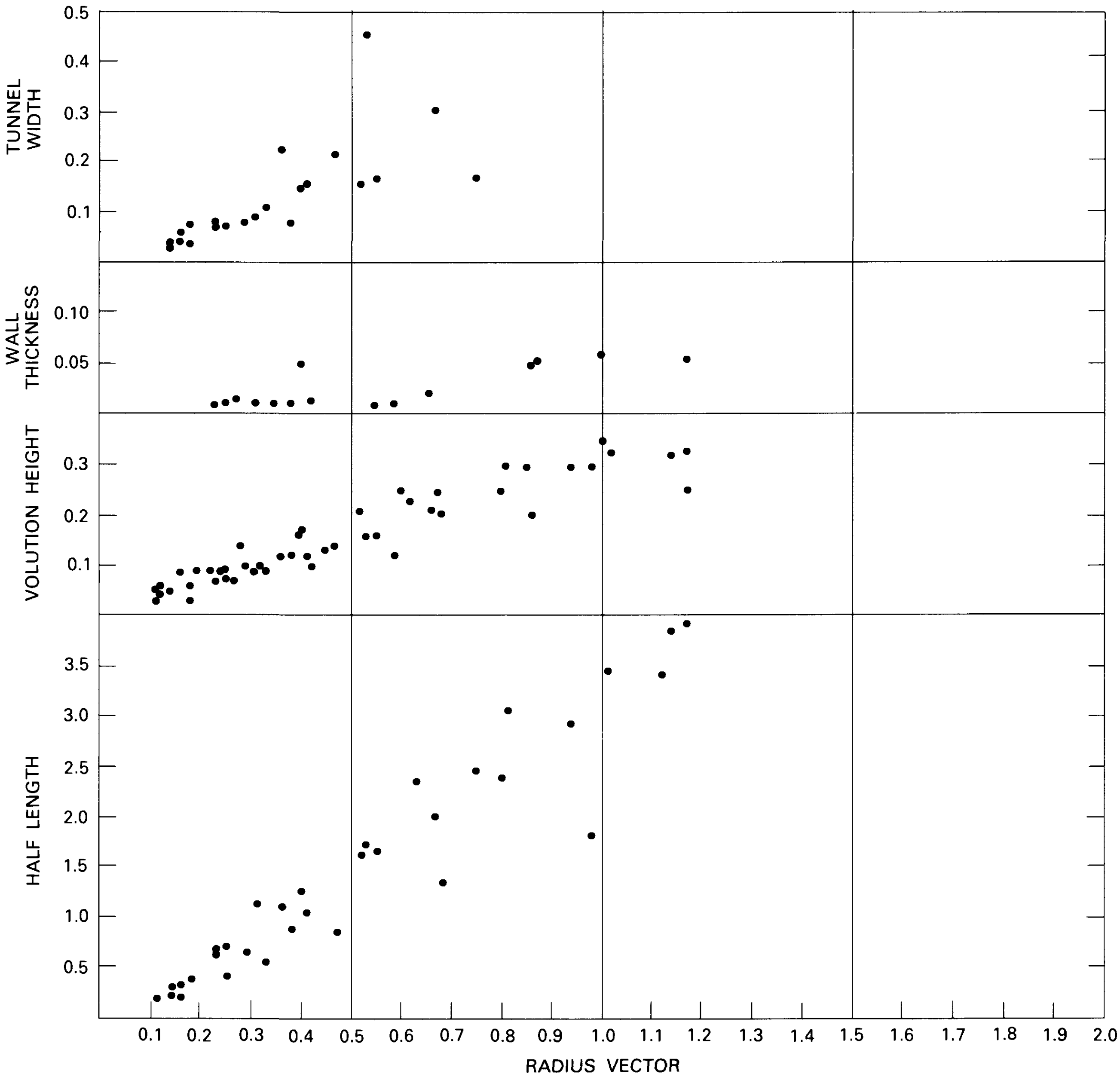


Figure 28.—Graphs for *Triticites kehni* Douglass n. sp. All measurements are in millimeters, and the values for each attribute are plotted against the radius vector.

TABLE 26.—*Measurements (in millimeters) for* Triticites callosus *Dunbar and Henbest, 1942*

[Leaders (____), data not available or character absent]

Character	Measurements of fossils shown in plate 20, figures 1-3, 5, 6				
	1	2	3	5	6
Diameter of proloculus	0.22	0.15	0.13	0.16	0.15
Radius vector					
1	0.23	0.14	0.13	0.19	0.18
2	.38	.22	.21	.32	.26
3	.63	.35	.35	.50	.50
4	.73	.54	.48	.71	.60
5	1.24	.835	.70	1.00	.645
6	1.61	1.155	.99	1.32	.90
7	____	1.48	1.34	____	1.26
8	____	____	1.74	____	____
9	____	____	____	____	____
Half length					
1	0.41	0.24	0.18	____	____
2	.84	.47	.31	____	____
3	1.44	.68	.54	____	____
4	2.12	1.07	.75	____	____
5	3.05	1.70	1.12	____	____
6	3.90	2.16	1.65	____	____
7	____	3.34	2.29	____	____
8	____	____	3.21	____	____
9	____	____	____	____	____
Volution height					
1	0.09	0.05	0.04	0.06	0.07
2	.14	.05	.08	.13	.09
3	.24	.12	.14	.17	.135
4	.30	.20	.14	.20	.23
5	.32	.29	.22	.29	.25
6	.36	.32	.28	.31	.36
7	____	.33	.35	____	____
8	____	____	.39	____	____
9	____	____	____	____	____
Wall thickness					
1	0.03	____	____	____	____
2	.04	____	.04	.03	____
3	.10	____	____	.05	.02
4	____	.05	.05	.06	____
5	____	.09	____	.08	.07
6	____	.09	____	____	____
Tunnel width (axials) or septal spacing					
1	0.07	0.04	0.04	0.04	0.03
2	.105	.06	.06	.05	.04
3	____	.095	.15	.05	.06
4	____	.12	____	.06	.07
5	____	.21	____	.10	.10
6	____	.23	.41	____	____
7	____	____	____	____	____
8	____	____	____	____	____

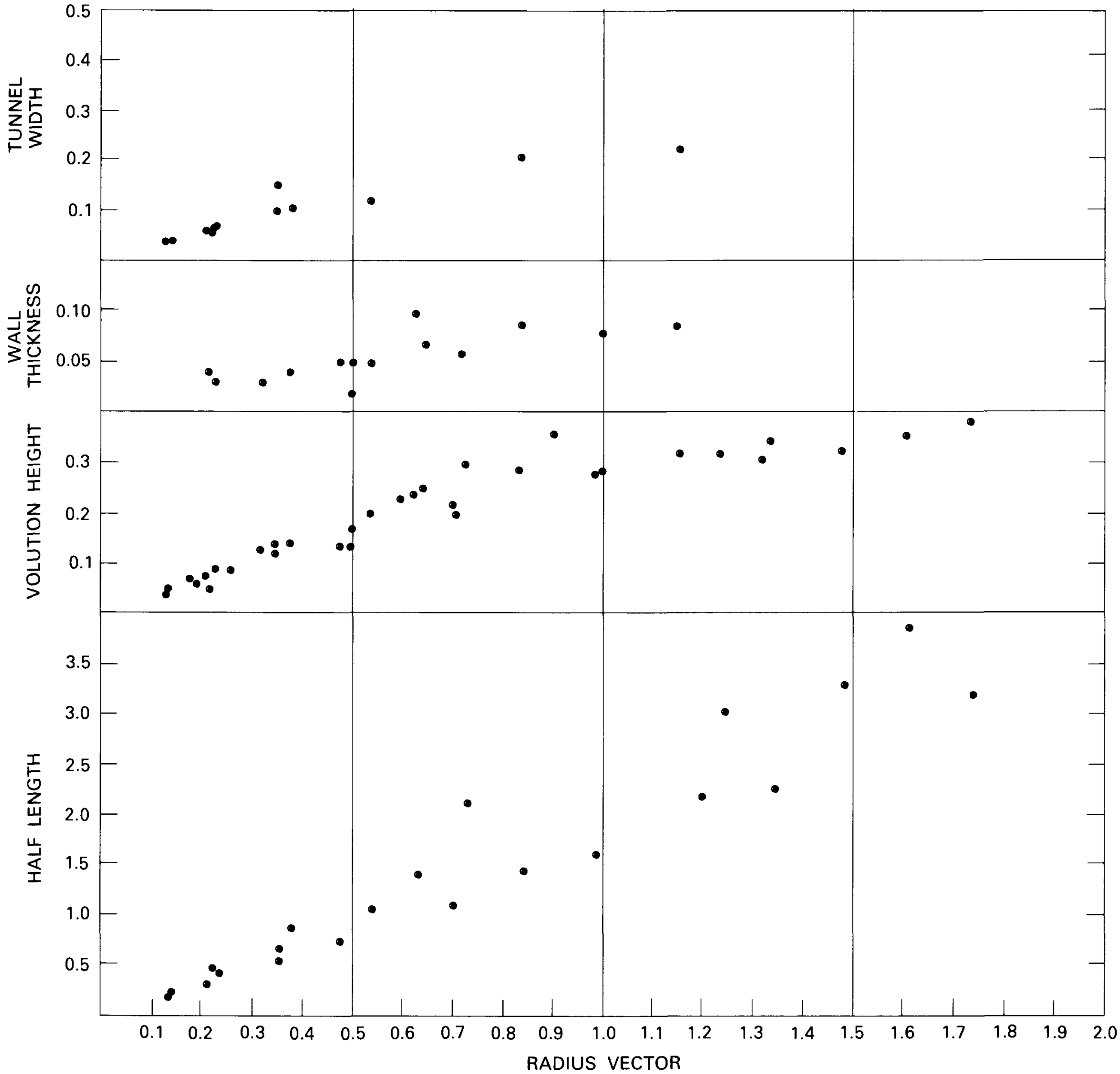


Figure 29.–Graphs for *Triticites callosus* Dunbar and Henbest, 1942. All measurements are in millimeters, and the values for each attribute are plotted against the radius vector.

TABLE 27.—*Measurements (in millimeters) for* Triticites mediocris *Dunbar and Henbest, 1942*

[Leaders (____), data not available or character absent]

Character	Measurements of fossils shown in plate 20, figures 4, 7–9			
	4	7	8	9
Diameter of proloculus	0.18	0.20	0.14	0.15
Radius vector				
1	0.16	0.13	0.15	0.14
2	.25	.21	.24	.25
3	.41	.335	.39	.41
4	.64	.50	.62	.60
5	.90	.705	.84	.89
6	____	.98	1.13	1.12
7	____	1.20	1.40	____
Half length				
1	0.22	0.22	____	0.17
2	.50	.40	____	.35
3	1.10	.66	____	.51
4	1.91	.97	____	.70
5	2.68	1.56	____	1.04
6	____	2.32	____	1.51
7	____	3.11	____	____
Volution height				
1	0.04	0.035	0.06	0.035
2	.10	.06	.08	.11
3	.16	.13	.15	.16
4	.22	.15	.22	.18
5	.25	.21	.22	.28
6	____	.27	.29	.24
7	____	.49	.27	____
Wall thickness				
1	____	____	____	____
2	.03	.03	.02	____
3	____	____	.02	____
4	____	____	.03	.05
5	____	____	.055	____
Tunnel width (axials) or septal spacing				
1	0.03	0.04	0.015	0.035
2	.075	.07	.025	.06
3	.11	.135	.05	.08
4	.19	.23	.075	.14
5	____	.34	.09	.14

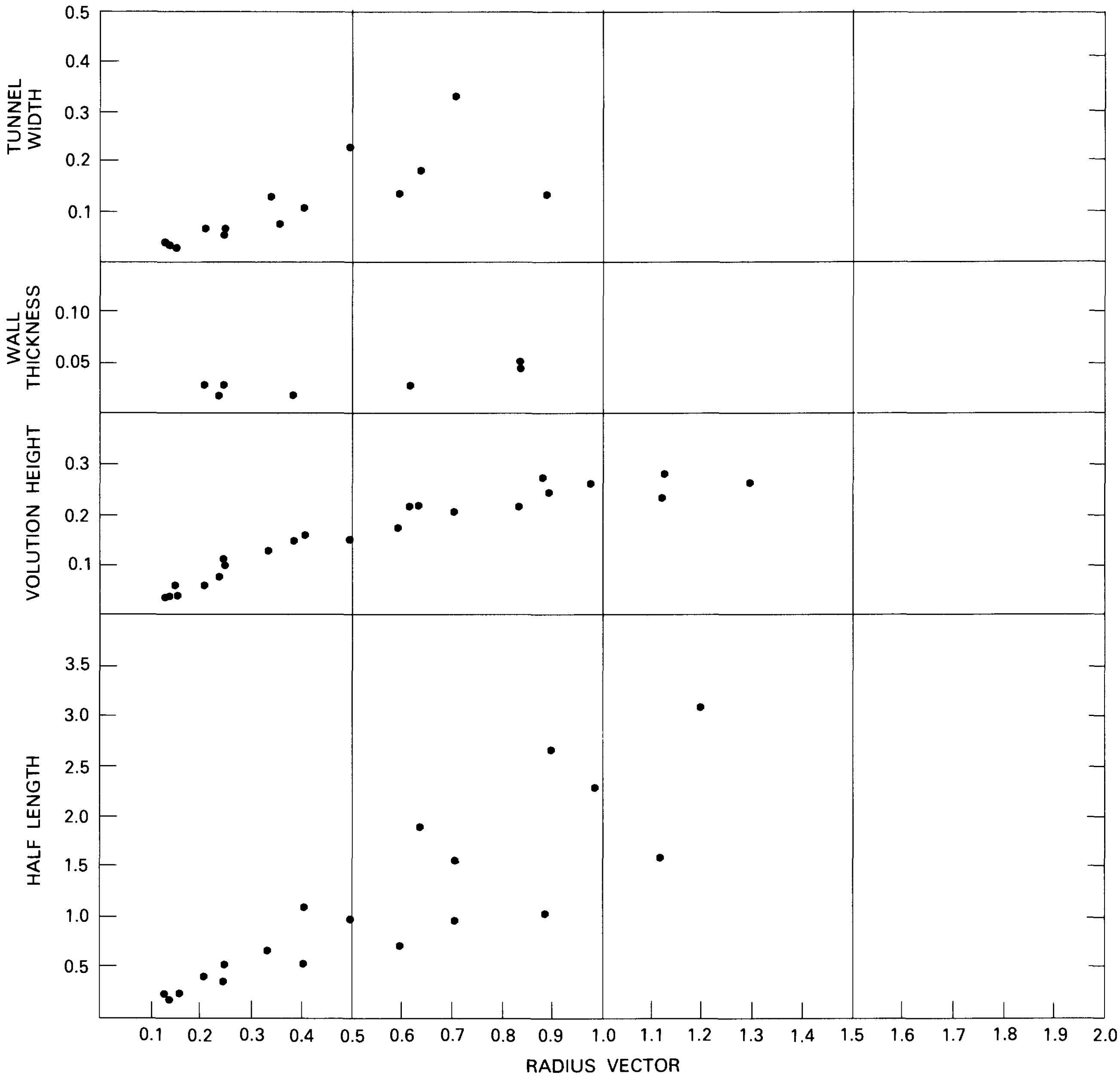


Figure 30. – Graphs for *Triticites mediocris* Dunbar and Henbest, 1942. All measurements are in millimeters, and the values for each attribute are plotted against the radius vector.

TABLE 28.—*Measurements (in millimeters) for* Triticites beardi *Douglass n. sp.*

[Leaders (____), data not available or character absent]

Character	Measurements of fossils shown in plate 20, figures 10, 12–15		
	10	12	15
Diameter of proloculus	0.21	0.23	0.20
Radius vector			
1	0.14	0.19	0.17
2	.20	.29	.26
3	.23	.425	.44
4	.33	.61	.62
5	.46	.845	.88
6	.67	1.03	1.15
7	.70	----	1.39
8	----	----	1.64
9	----	----	1.86
Half length			
1	0.21	0.33	0.31
2	.37	.62	.44
3	.55	.96	.60
4	.80	1.52	.90
5	1.09	2.27	1.09
6	1.48	----	1.41
7	----	----	2.06
8	----	----	2.79
9	----	----	3.59
Volution height			
1	0.03	0.07	0.05
2	.06	.10	.09
3	.13	.13	.18
4	.13	.18	.19
5	.20	.23	.25
6	.23	.29	.27
7	----	----	.24
8	----	----	.25
9	----	----	.24
Wall thickness			
1	0.02	0.02	0.02
2	.03	.02	.03
3	.04	.03	.04
4	.03	.05	.05
5	.04	.05	.06
6	.05	----	.06
Tunnel width (axials) or septal spacing			
1	----	0.045	0.07
2	----	.055	.08
3	----	.08	.08
4	----	.13	.12
5	----	----	.20
6	----	----	.28
7	----	----	.25
8	----	----	.29

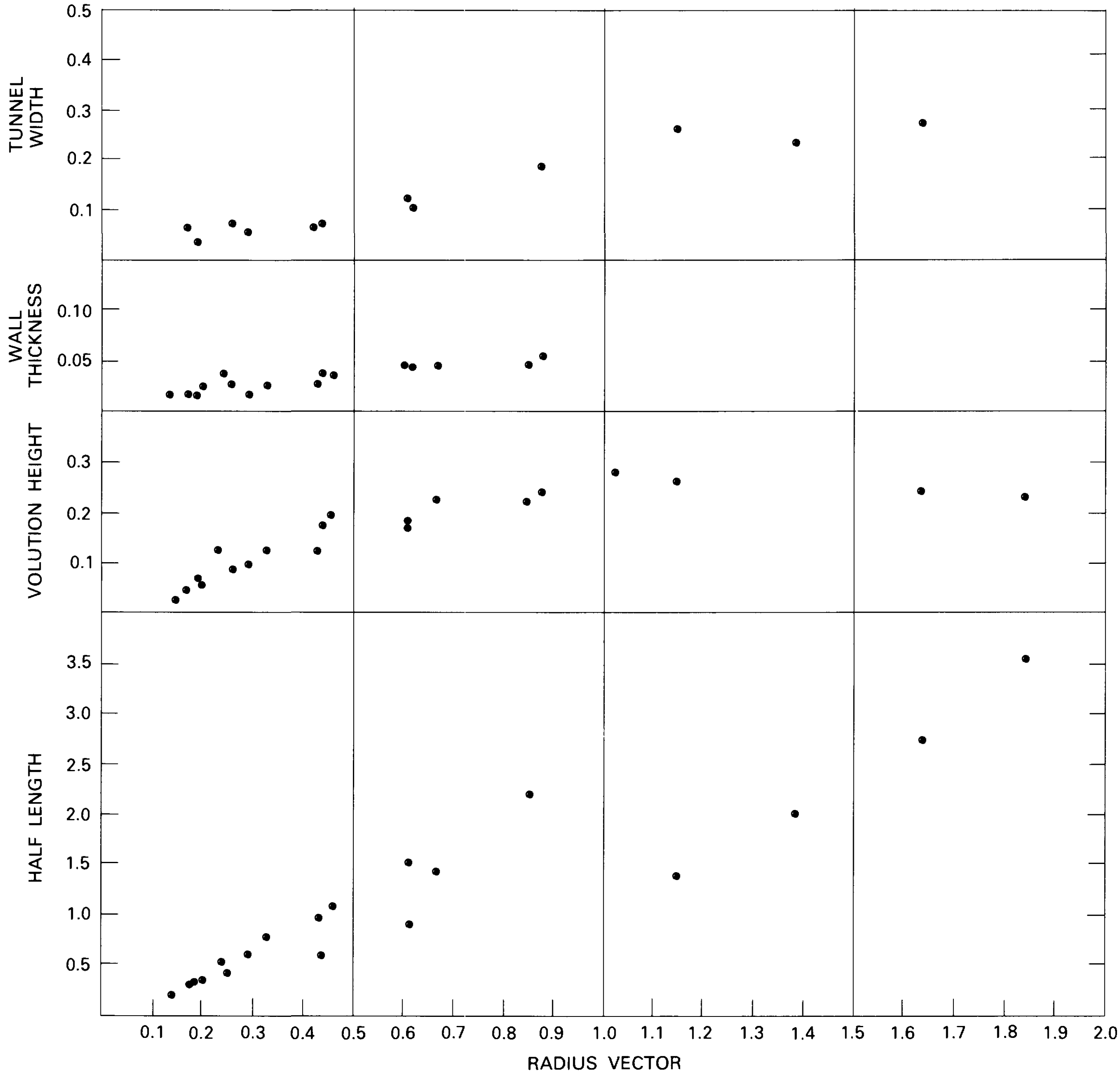


Figure 31.–Graphs for *Triticites beardi* Douglass n. sp. All measurements are in millimeters, and the values for each attribute are plotted against the radius vector.

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PLATES 1-20

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U.S. Geological Survey Library, Federal Center, Denver, Colorado 80225

PLATE 1

Figures 1–31. *Profusulinella kentuckyensis* Thompson and Riggs, 1959 (p. 26)

1–12. Refigured types from surface samples.

1–3. Holotype, X20, X50, and X100.
Specimen shows twisting of coiling axis through first volutions and traces of inner tectorium in fourth and fifth volutions. ISGS (Illinois State Geological Survey) specimen 13P–1.

4. Axial section, X20. Axis does not rotate in this specimen. Paratype, ISGS 13P–6.

5. Axial section, X20. Small paratype, ISGS 13P–3.

6–7. Equatorial section, X20 and X50. Paratype, ISGS 13P–14.

8–9. Equatorial sections, X20, X50, and X100. Paratype, ISGS 13P–12.

10–12. Equatorial section, X20, X50, and X100. This specimen shows some fibrous structure in diaphanotheca in outer volutions. Paratype, ISGS 13P–13.

13–31. Specimens from core samples.

13–14. Axial section, X20 and X50, from locality 31, sample f13740B–4, at depth of 181.9 ft. Hypotype, USNM 368648.

15–16. Axial section, X50 and X20, from locality 31, sample f13740A–1, at depth of 184.2 ft. Hypotype, USNM 368649.

17–18. Axial section, X50 and X20, from locality 31, sample f13740A–3, at depth of 184.2 ft. Hypotype, USNM 368650.

19. Axial section from locality 13, sample f13923–1, at depth of 46.3 ft. Hypotype, USNM 368651.

20. Axial section, X20, from same locality as fig. 19. Hypotype, USNM 368652.

21. Equatorial section, X20, from locality 11, sample f13908–4, at depth of 120 ft. Hypotype, USNM 368653.

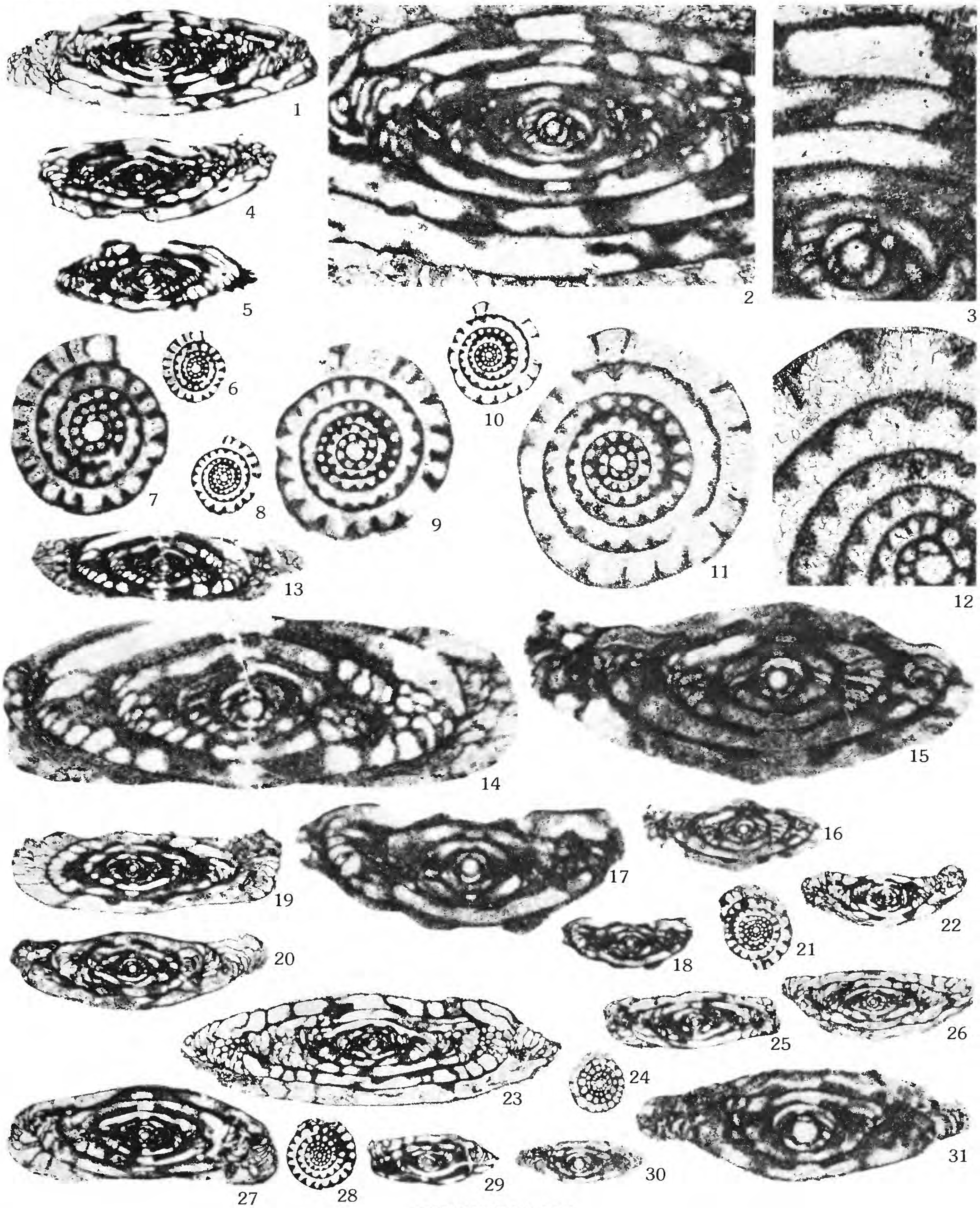
22. Axial section, X20, from same locality as fig. 21. Hypotype, USNM 368654.

23–26. Equatorial and axial sections, X20, from same locality as fig. 21 but from depth of 122.6 ft. Sample f13909. Hypotypes, USNM 368655–368658.

27. Axial section, X20, from locality 13, sample f13924–2, at depth of 76.5 ft. Hypotype, USNM 368659.

28, 29. Equatorial and axial sections, X20, from locality 37, sample f13746, at depth of 168 ft. Hypotypes, USNM 368660, 368661.

30, 31. Axial section, X20 and X50, from locality 11, sample f13911–2, at depth of 148.5 ft. Hypotype, USNM 368662.



PROFUSULINELLA

PLATE 2

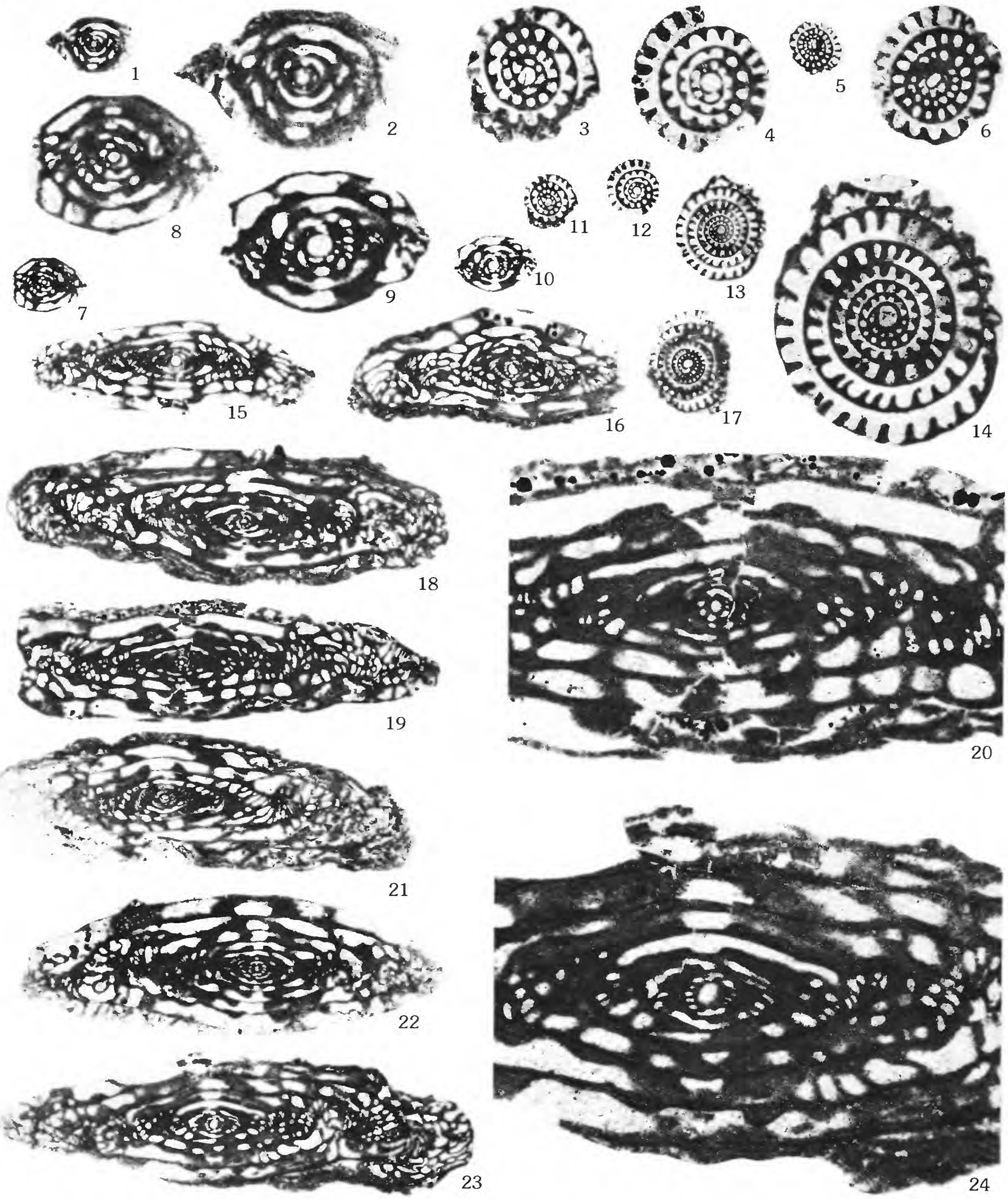
[All specimens illustrated are from locality 67, collection f14509, Boggs Limestone Member of Pottsville Formation]

Figures 1–12. *Profusulinella ohioensis* Douglass n. sp. (p. 26).

1, 2. Axial section, X20 and X50. Paratype, USNM 368663.
3, 11. Equatorial section, X50 and X20. Paratype, USNM 368667.
4, 12. Equatorial section, X50 and X20. Paratype, USNM 368668.
5, 6. Equatorial section, X20 and X50. Paratype, USNM 368664.
7, 8. Axial section, X20 and X50. Paratype, USNM, 368665.
9, 10. Axial section, X50 and X20. Holotype, USNM, 368666.

13–24. *Fusulinella imprima* Douglass n. sp. (p. 28)

13, 14. Equatorial section, X20 and X50. Paratype, USNM 368669.
15. Axial section, X20. Paratype, USNM 368670.
16. Axial section, X20. Paratype, USNM 368671.
17. Equatorial section, X20. Paratype, USNM 368672.
18. Axial section, X20. Paratype, USNM 368673.
19, 20. Axial section, X20 and X50. Holotype, USNM 368674.
21. Axial section, X20. Paratype, USNM 368675.
22. Axial section, X20, showing septal pores exceptionally well in outer volution. Paratype USNM 368676.
23, 24. Axial section, X20 and X50. Paratype, USNM 368677.



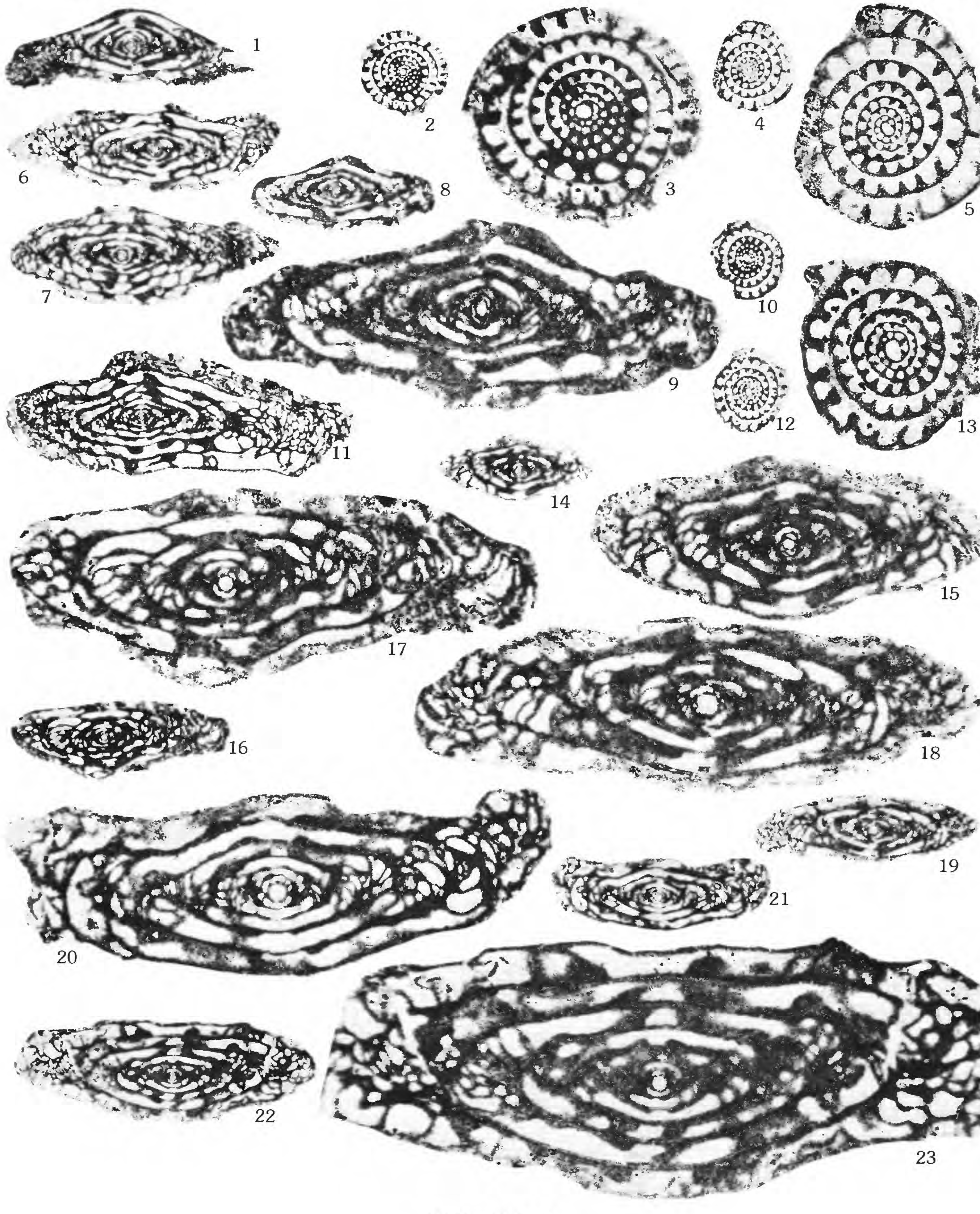
PROFUSULINELLA, FUSULINELLA

PLATE 3

[All specimens illustrated are from locality 21, collection f13927, at depth of 471.5–471.7 ft]

Figures 1–23. *Fusulinella primotina* Douglass n. sp. (p. 29).

1. Axial section, X20. Paratype, USNM 368678.
2, 3. Equatorial section, X20 and X50. Paratype, USNM 368679.
4, 5. Equatorial section, X20 and X50. Paratype, USNM 368680.
6. Axial section, X20. Paratype, USNM 368681.
7. Axial section, X20. Paratype, USNM 368682.
8, 9. Axial section, X20 and X50. Paratype, USNM 368683.
10. Equatorial section, X20. Paratype, USNM 368684.
11. Axial section, X20. Paratype, USNM 368685.
12, 13. Equatorial section, X20 and X50, showing some development of inner tectorium in outer volutions. Paratype, USNM 368686.
14, 15. Axial section, X20 and X50. Paratype, USNM 368687.
16, 17. Axial section, X20 and X50. Paratype, USNM 368688.
18, 19. Axial section, X50 and X20, Paratype, USNM 368689.
20, 21. Axial section, X50 and X20. Holotype, USNM 368690.
22, 23. Axial section, X20 and X50. Paratype, USNM 368691.



FUSULINELLA

PLATE 4

[All specimens illustrated are from locality 46, from samples through 30 ft of Stoney Fork Member of Breathitt Formation. Samples are in stratigraphic order from collection f13788 below to f13794 at top]

Figures 1–18. *Fusulinella pria* Douglass n. sp. (p. 31).

1. Axial section, X20, sample f13793–1. Paratype, USNM 368692.
2. Equatorial section, X20, sample f13793–7. Paratype, USNM 368693.
3. Axial section, X20, sample f13794–1. Paratype, USNM 368694.
4. Axial section, X20, sample f13792–1. Paratype USNM 368695.
5. Axial section, X20, sample f13792–2. Paratype, USNM 368696.
6. Equatorial section, X20, sample f13792–10. Paratype, USNM 368697.
7. Axial section, X20, sample f13791–1. Paratype, USNM 368698.
8. Equatorial section, X20, sample f13791–4. Paratype, USNM 368699.

9, 11. Equatorial section, X20 and X50, sample f13789–6. Paratype, USNM 368700.

10. Equatorial section, X20, sample f13790–6. Paratype, USNM 368701.

12. Axial section, X20, sample f13790–2. Paratype USNM 368702.

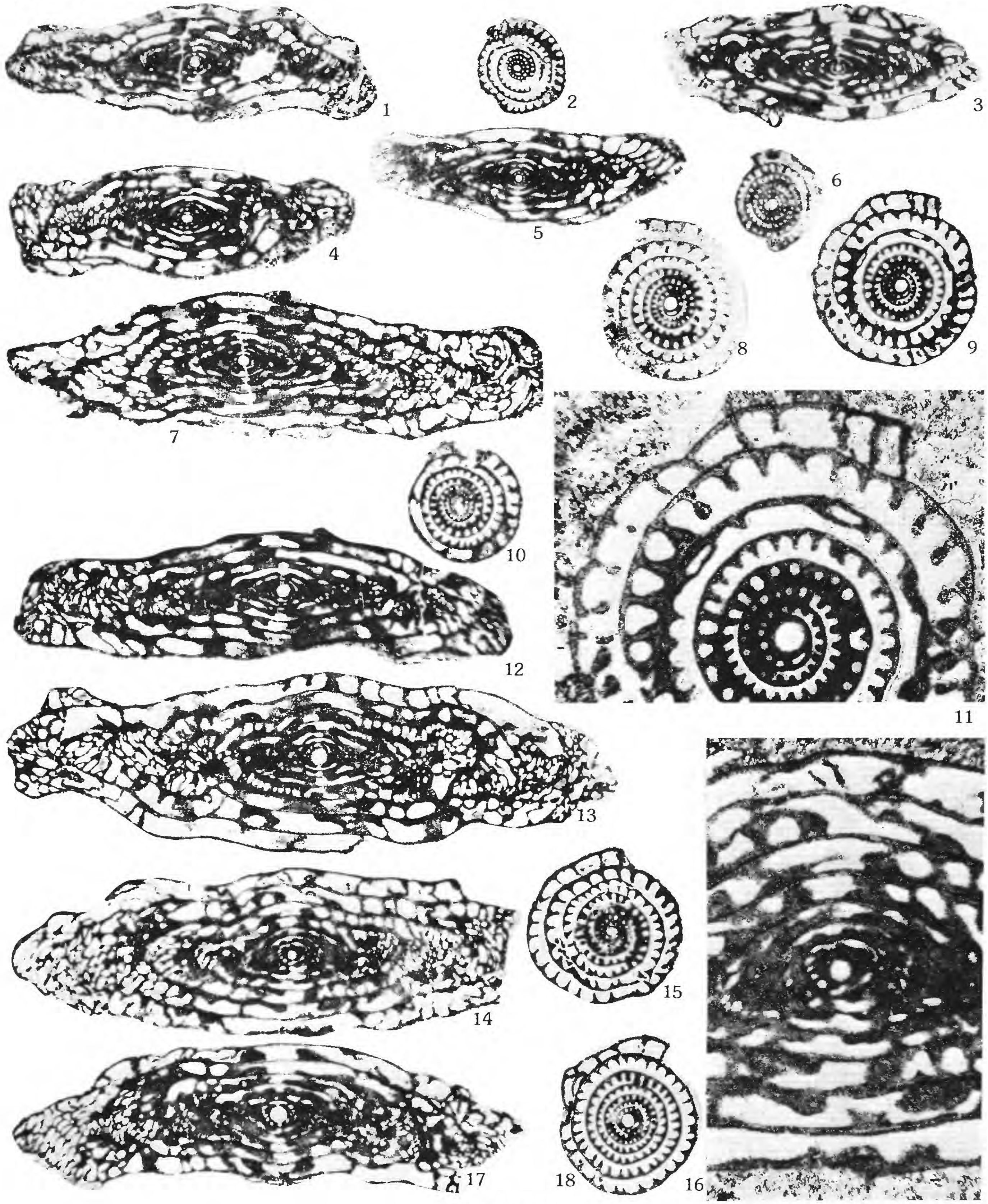
13. Axial section, X20, sample f13789–1. Paratype USNM 368703.

14, 16. Axial section, X20 and X50, sample f13788–1. Holotype, USNM 368704.

15. Equatorial section, X20, sample f13788–5. Paratype, USNM 368705.

17. Axial section, X20, sample f13788–2. Paratype, USNM 368706.

18. Equatorial section, X20, sample f13788–7. Paratype, USNM 368707.



FUSULINELLA

PLATE 5

[All specimens illustrated are from the type Curlew Limestone Member of the Tradewater Formation at locality 17, but in stratigraphic order from top to bottom of the unit shown from top to bottom of the plate. All figures X20]

Figures 1–26. *Fusulinella stouti* Thompson, 1936 (p. 33).

1–5. Specimens from sample f13899 from upper beds on Indian Hill, showing tighter coiling and more fluting than most of the specimens from lower beds.

1. Axial section, f13899–5. Hypotype, USNM 369708.
2. Axial section, f13899–11. Hypotype, USNM 368709.
3. Equatorial section, f13899–14. Hypotype,USNM 368710.
4. Axial section, f13899–1. Hypotype, USNM 368711.
5. Axial section, f13899–10. Hypotype, USNM 368712.

6–15. Specimens from sample f13898 from 3 ft limestone considered principal bed of Curlew.

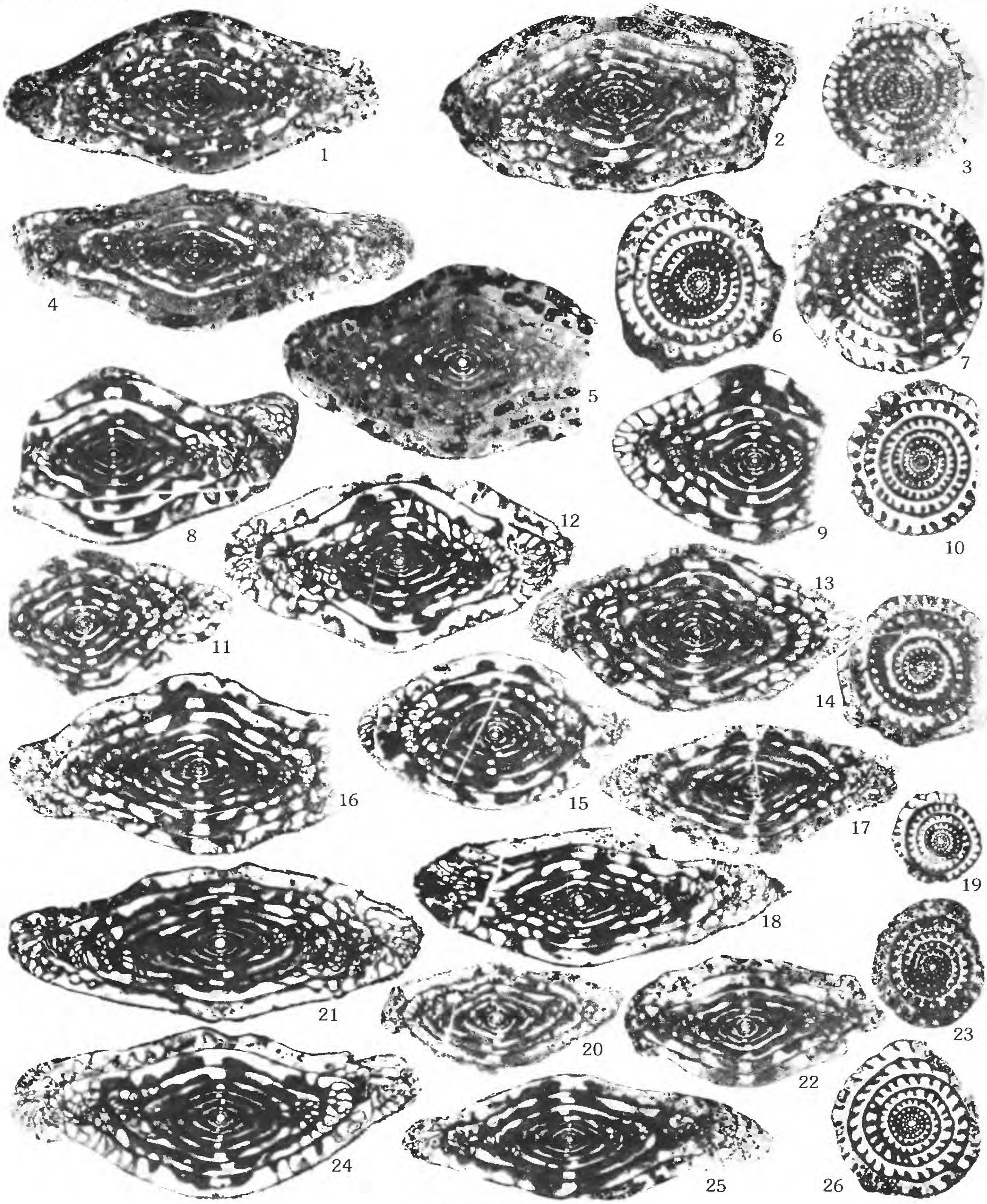
6. Equatorial section, f13898–11. Hypotype, USNM 368713.
7. Equatorial section, f13898–23. Hypotype, USNM 368714.
8. Axial section, f13898–8. Hypotype, USNM 368715.
9. Axial section, f13898–15. Hypotype, USNM 368716.
10. Equatorial section, f13898–40. Hypotype, USNM 368717.
11. Axial section, f13989–19. Hypotype, USNM 368718.
12. Axial section, f13898–28. Hypotype, USNM 368719.
13. Axial sectioin, f13898–27. Hypotype, USNM 368720.
14. Equaorial section, f13898–10. Hypotype, USNM 368721.
15. Axial section, f13898–2. Hypotype, USNM 368722.

16–20. Specimens from sample f13629 from the 3 ft limestone.

16. Axial section, f13629–12. Hypotype USNM 368723.
17. Axial section, f13629–1. Hypotype, USNM 368724.
18. Axial section, f13629–17. Hypotype, USNM 368725.
19. Equatorial section, f13629–18. Hypotype, USNM 368726.
20. Axial section, f13629–16. Hypotype, USNM 368727.

21–26. Specimens from sample f13897 from flaggy limestone, 6–8 in. below the 3-ft limestone.

21. Axial section, f13897–1. Hypotype, USNM 368728.
22. Axial section, f13897–3. Hypotype, USNM 368729.
23. Equatorial section, f13897–7. Hypotype, USNM 368730.
24. Axial section, f13897–2. Hypotype, USNM 368731.
25. Axial section, f13897–3. Hypotype, USNM 368732.
26. Equatorial section, f13897–5. Hypotype USNM 368733.



FUSULINELLA

PLATE 6

[All figures X20]

Figures 1–16. *Fusulinella iowensis* Thompson, 1934 (p. 34) (See also pl. 15).

1–7. Reillustration of specimens illustrated by Thompson and Riggs (*in* Thompson, Shaver, and Riggs, 1959) from type Curlew Limestone Member of Tradewater Formation.

1. Axial section. Hypotype, ISGS (Illinois State Geological Survey) 13P–21.
2. Axial section. Hypotype, ISGS 13P–20.
3. Equatorial section. Hypotype, ISGS 13P–16.
4. Axial section. Hypotype, ISGS 13P–22.
5. Axial section. Hypotype, ISGS 13P–25.
6. Equatorial section. Hypotype, ISGS 13P–19.
7. Equatorial section. Hypotype, ISGS 13P–18.

8–11, 15. Specimens from Curlew equivalent at locality 31, sample f13741B, at depth of 74.5 ft.

8. Axial section. Hypotype, USNM 368734.
9. Axial section. Hypotype, USNM 368735.
10. Axial section. Hypotype, USNM 368736.
11. Equatorial section. Hypotype, USNM 368737.
15. Equatorial section. Hypotype, USNM 368741.

12–14. Specimens from Curlew equivalent at locality 21, sample f13926, at depth of 469 ft.

12. Axial section. Hypotype, USNM 368738.
13. Axial section. Hypotype, USNM 368739.
14. Equatorial section. Hypotype, USNM 368740.

16. Axial section from locality 32, sample f13635–1. Hypotype, USNM 368745.

17–22. *Fusulinella* sp. (p. 35).

17–19. Specimens from locality 32, sample f13635.

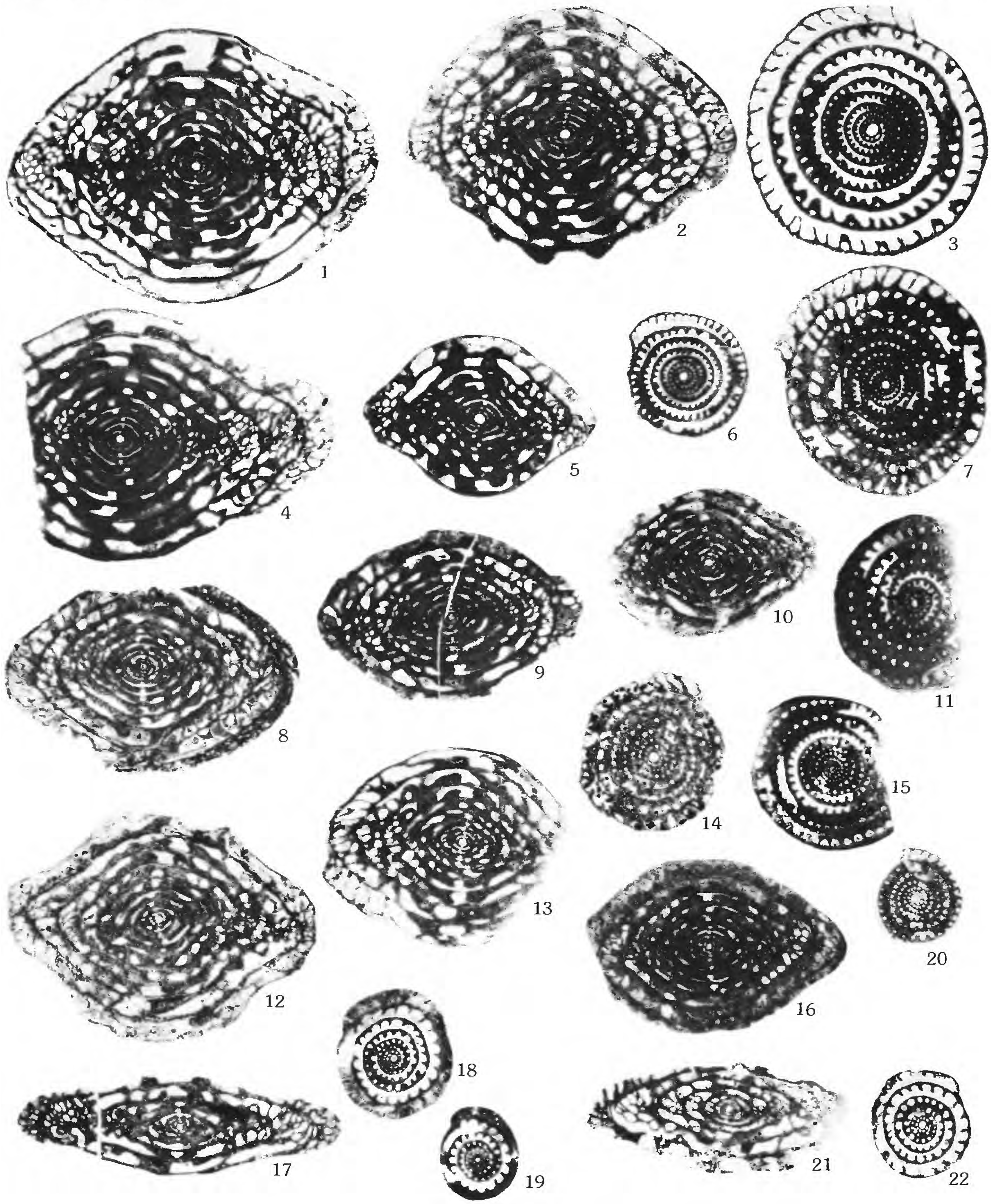
17. Axial section. USNM 368742.

18, 19. Equatorial sections. USNM 368743, 368744.

20. Equatorial section from locality 21, sample f13926–5, from depth of 469 ft. USNM 368746.

21, 22. Specimens from locality 31, sample f13741B, at 74.5 ft.

21. Axial section. USNM 368747.
22. Equatorial section. USNM 368748.



FUSULINELLA

PLATE 7

[All figures X20]

Figures 1–42. *Wedekindellina euthysepta* (Henbest), 1928 (p. 36) (see also pl. 16).

Surface samples

1–4, 6–8. Specimens from locality 39, sample f13906, from Yeargins limestone member (informal usage) of Tradewater Formation, Butler County, Ky.

- 1–4. Axial sections. Hypotypes, USNM 368749–368752.
- 6. Axial section. Hypotype, USNM 368754.
- 7. Equatorial section. Hyopotype, USNM 368755.
- 8. Axial section. Hypotype, USNM 368756.

5, 10, 11. Specimens from locality 39, sample f13905, from 3.5 ft below f13906.

- 5. Axial section. Hypotype, USNM 368753.
- 10. Equatorial section. Hypotype, USNM 368758.
- 11. Axial section. Hypotype, USNM 368759.

9, 13, 14. Specimens from locality 41, sample f13902, Yeargins limestone member in Ohio County, Ky. Axial sections. Hypotypes, USNM 368757, 368761, 368762.

12, 16, 18, 19. Specimens from locality 32, sample f13636, Yeargins limestone member in Christian County, Ky.

- 12, 16. Axial sections. Hypotypes, USNM 368760, 368764.
- 18, 19. Equatorial sections. Hypotypes, USNM 368766, 36867.

Subsurface samples

15, 17. Specimens from locality 18, sample f13745, at depth of 265 ft, near top of Yeargins limestone member.

- 15. Axial section. Hypotype,USNM 368763.
- 17. Equatorial section. Hypotype, USNM 368765.

20–22. Specimens from locality 31, sample f13742, at depth of 4.1–4.3 ft in Yeargins limestone member. Axial sections. Hypotypes, USNM 368768, 368770.

23–27, 31, 33, 34. Specimens from locality 18, sample f13744, at depth of 267 ft, near base of Yeargins limestone member.

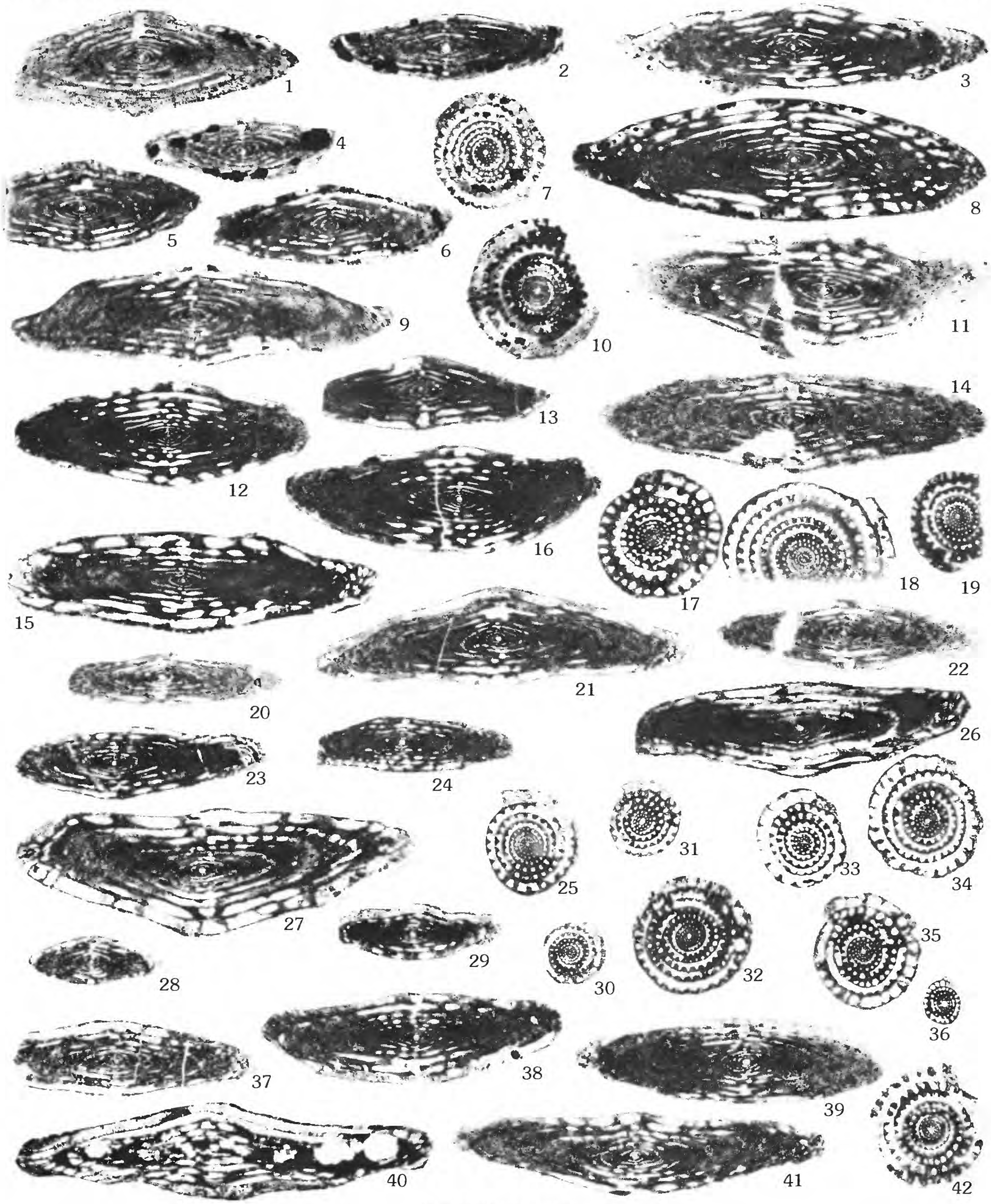
- 23, 24. Axial sections. Hypotypes, USNM 368771, 368772.
- 25. Equatorial section. Hypotype, USNM 368773.
- 26, 27. Axial sections. Hypotype, USNM 368774, 368775.
- 31, 33, 34. Equatorial sections. Hypotypes, USNM 368779, 368781, 368782.

28–30, 32, 35, 36, 38, 39, 41, 42. Specimens from locality 40, sample f13752, from Yeargins limestone member at depths of 313–316 ft.

- 28, 29. Axial sections of small specimens. Hypotypes, USNM 368776, 368777.
- 30, 32, 35, 36. Equatorial sections. Hypotypes, USNM 368778, 368780, 368783, 368784.
- 38, 39. Axial sections. Hypotypes, USNM 368786, 368787.
- 41. Axial section. Hypotype, USNM 368789.
- 42. Equatorial section. Hyoptype, USNM 368790.

37. Specimen from locality 21, sample f13925, at depth of 398 ft, in Yeargins limestone member. Axial section. Hypotype, USNM 368785.

40. Tangential section from locality 31, sample f13741, at depth of 37 ft in Yeargins limestone member. Hypotype, USNM 368788.



WEDEKINDELLINA

PLATE 8

[*Beedeina* from drill cores in Yeargins limestone member (informal usage) of Tradewater Formation, western Kentucky]

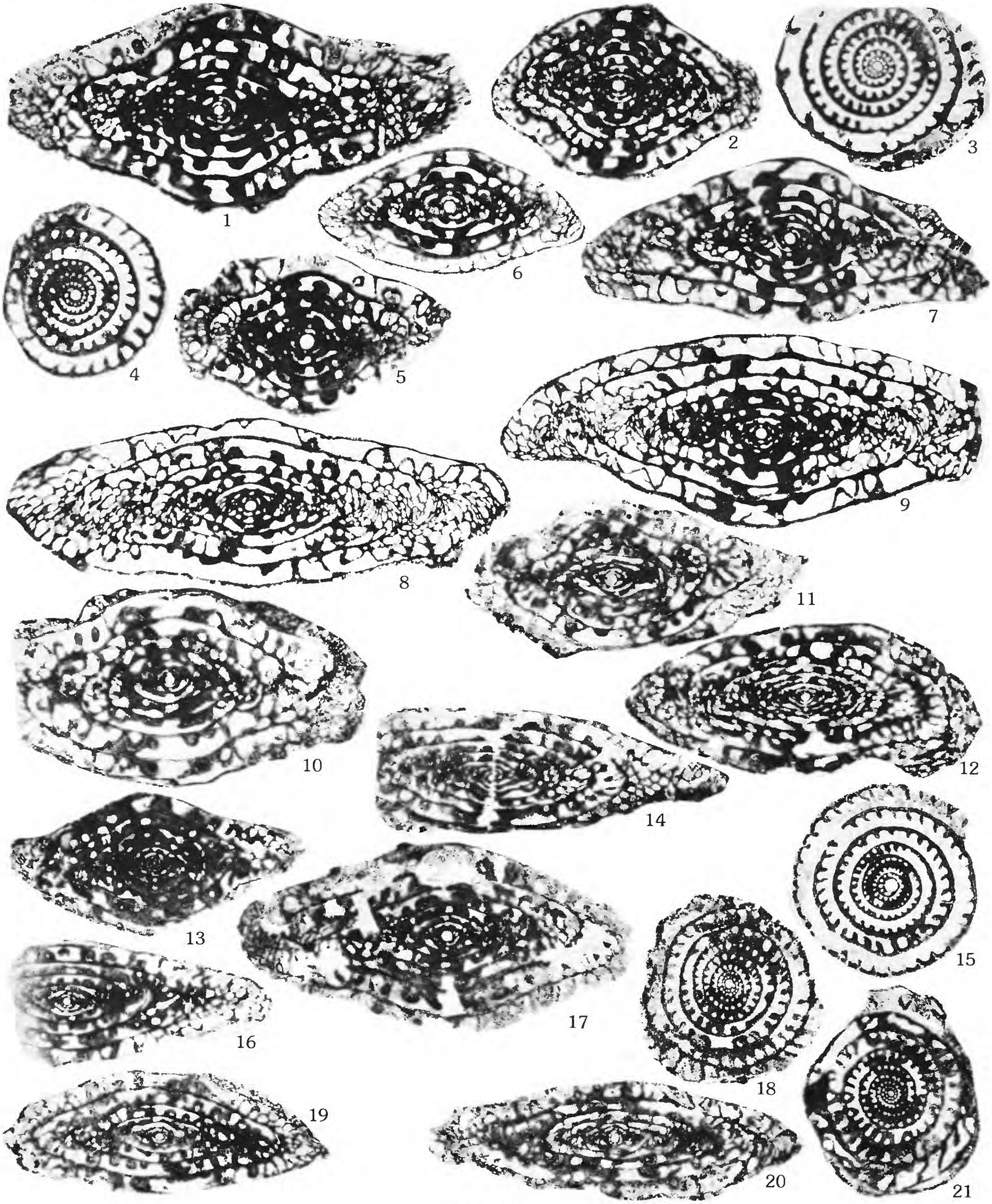
[All figures X20]

Figures 1–3, 5, 6. *Beedeina* sp. aff. *B. novamexicana* (Needham), 1937 (p. 38) (see also pls. 9, 10).
From locality 18, sample f13745, at depth of 265 ft.
1, 2, 5, 6. Axial sections showing varieties of shape. USNM 368791, 368792, 368795, 368796.
3. Equatorial section. USNM 368793.

4, 7–9. *Beedeina leei* (Skinner), 1931 (p. 39) (see also pls. 9, 10, 15, 17).
From locality 18, sample f13744, at depth of 267 ft.
4. Equatorial section. Hypotype, USNM 368794.
7–9. Axial sections showing variation in shape.
Hypotypes, USNM 368797–368799.

10, 13, 15, 17. *Beedeina* sp. aff. *B. leei* (Skinner), 1931 (p. 40) (see also pl. 12).
10. Axial section from locality 21, sample f13925–3, at depth of 398.1 ft. USNM 368800.
13, 15, 17. Specimens from locality 31, sample f13742, at depth of 4.1–4.3 ft.
13. Axial section of microspheric specimen. USNM 368803.
15. Equatorial section. USNM 368805.
17. Axial section. UNMN 368807.

11, 12, 14, 16,
18–21. *Beedeina* sp. aff. *B. spissiplicata* (Dunbar and Henbest), 1942 (p. 41) (see also pl. 9).
11. Axial section from locality 35, sample f13919–3, at depth of 177.6 ft. USNM 368801.
12, 14. Axial sections from locality 33, sample f13750, at depth of 150 ft. USNM 368802, 368804.
16, 18–21. Specimens from locality 31, sample f13741, at depth of 36–38 ft.
16. Axial section. USNM 368806.
18. Equatorial section. USNM 368808.
19, 20. Axial sections. USNM 368809, 368810.
21. Equatorial section. USNM 368811.



BEEDEINA

PLATE 9

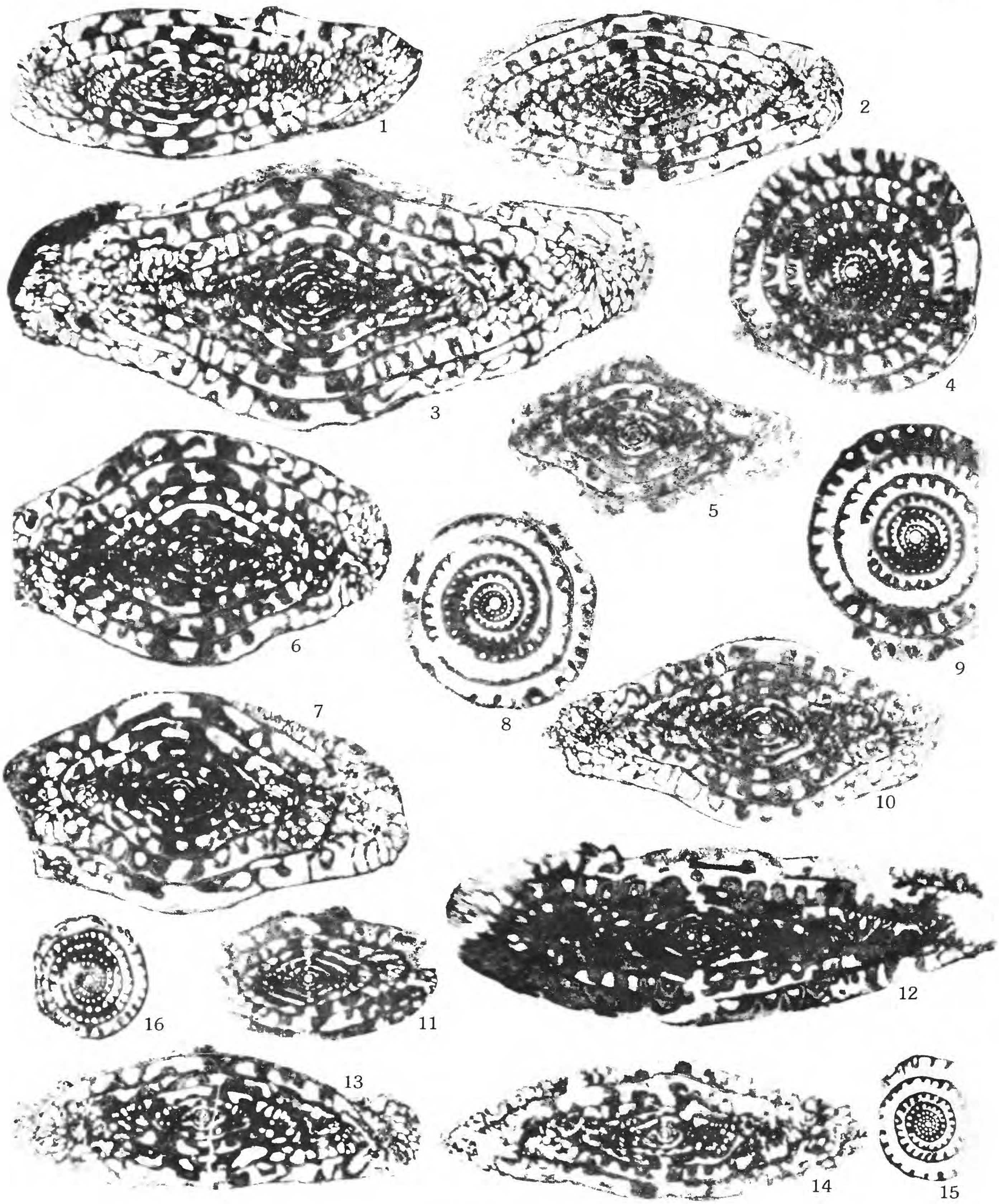
[*Beedeina* from locality 40, representing depths from 185 through 332 ft, in drill core Gil No. 9]

[All figures X20]

Figures 1, 2. *Beedeina leei* (Skinner), 1931 (p. 39) (see also pls. 8, 10, 15, 17).
Axial sections from sample f13753 at depth of 185 ft.
Hypotypes, USNM 368812, 368813.

3–10. *Beedeina* sp. aff. *B. novamexicana* (Needham), 1937 (p. 38) (see also pls. 8, 10).
Specimens from sample f13752, at depth of 313–316 ft.
3. Large axial section resembling some of specimens illustrated from Stonefort Limestone Member of Spoon Formation in Illinois. USNM 368814.
4. Large equatorial section of similar form. USNM 368815.
5. Axial section of microspheric specimen. USNM 368816.
6, 7. Axial sections of smaller megalospheric specimens. USNM 368817, 368818.
8, 9. Equatorial sections. USNM 368819, 368820.
10. Axial section. USNM 368821.

11–16. *Beedeina* sp. aff. *B spissiplicata* (Dunbar and Henbest), 1942 (p. 41) (see also pl. 8).
Specimens from sample f13751, at depth of 332 ft.
11–14. Axial sections showing variety of shapes. Figure 12 has double proloculus but otherwise is similar to specimen illustrated by Dunbar and Henbest on pl. 7 as fig. 5. Specimens are UNSM 368822–368825.
15, 16. Equatorial sections. USNM 368826, 368826A.



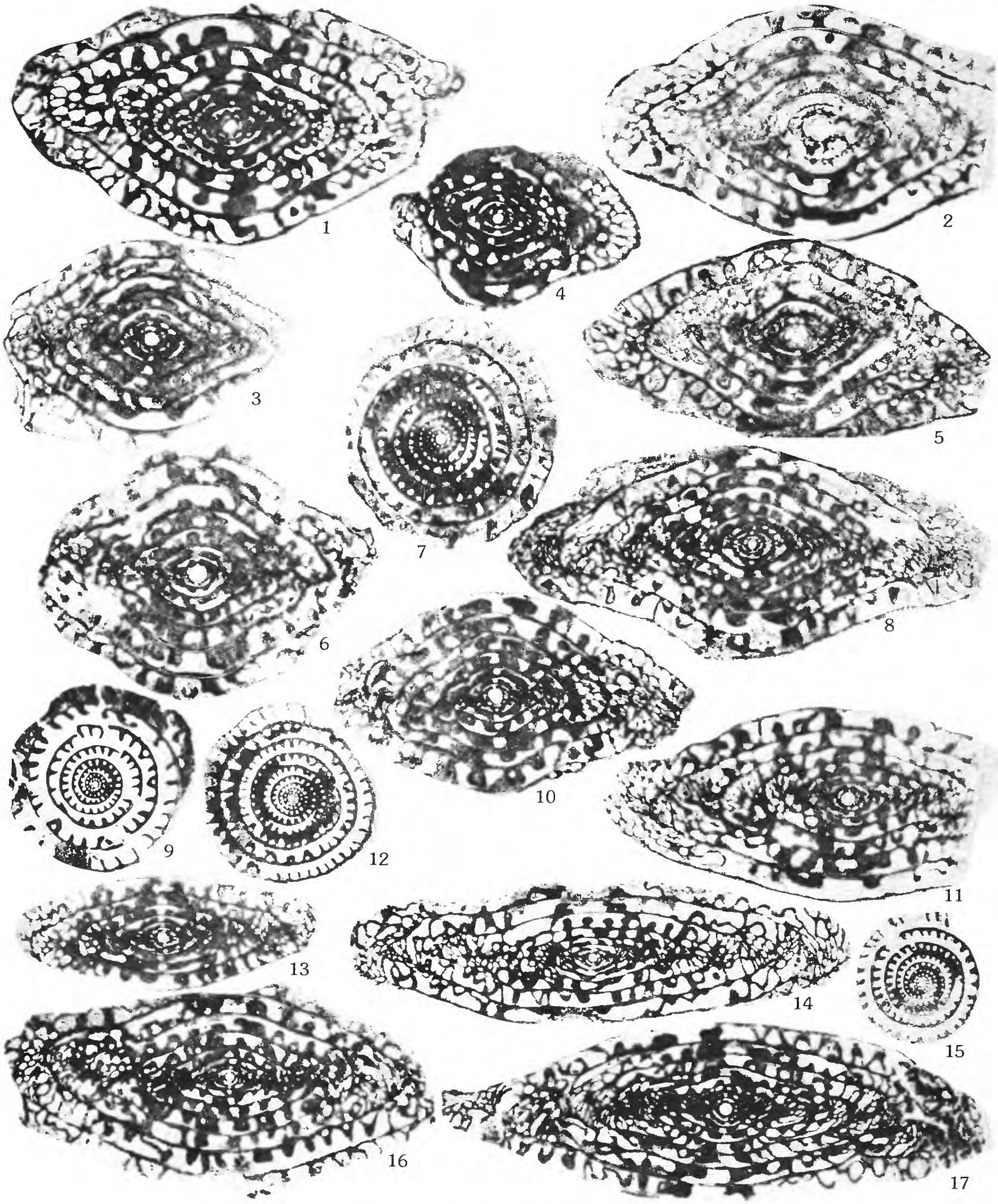
BEEDEINA

PLATE 10

[*Beedeina* from surface samples of Yeargins limestone member (informal usage) of Tradewater Formation, western Kentucky]

[All figures X20]

Figures 1–8, 10, 11. *Beedeina* sp. aff. *B. novamexicana* (Needham), 1937 (p. 38) (see also pls. 8, 9).
1–5. Axial sections from locality 39, sample f13904. USNM 368827–368831.
6–8, 10, 11. Specimens from locality 41, sample f13902.
6. Axial section. USNM 368832.
7. Equatorial section. USNM 368833.
8, 10, 11. Axial sections. USNM 368834, 368836, 368837.
9, 12–17. *Beedeina leei* (Skinner), 1931 (p. 39) (see also pls. 8, 9, 15, 17). Specimens from locality 32, sample f13636.
9, 12, 15. Equatorial sections. USNM 368835, 368838, 368841.
13, 14, 16, 17. Axial sections. USNM 368839, 368840, 368842, 368843.



BEEDEINA

PLATE 11

[All figures X20]

Figures 1–19. *Beedeina ashlandensis* Douglass n. sp. (p. 43).

1–9. Specimens from locality 61, sample f14308, showing variation in shape.

1, 2. Axial sections. Paratypes, USNM 368844, 368845.

3. Equatorial section. Paratype, USNM 368846.

4, 5. Axial sections. Paratypes, USNM 368847, 368848.

6. Equatorial section. Paratype, USNM 368849.

7, 8. Axial sections. Paratypes, USNM 368850, 368851.

9. Equatorial section. Paratype, USNM 368852.

10, 16–19. Specimens from locality 62, sample f13787.

10. Axial section. Paratype, USNM 368853.

16. Equatorial section. Paratype, USNM 368859.

17. Axial section. Paratype, USNM 368860.

18. Axial section. Holotype, USNM 368861.

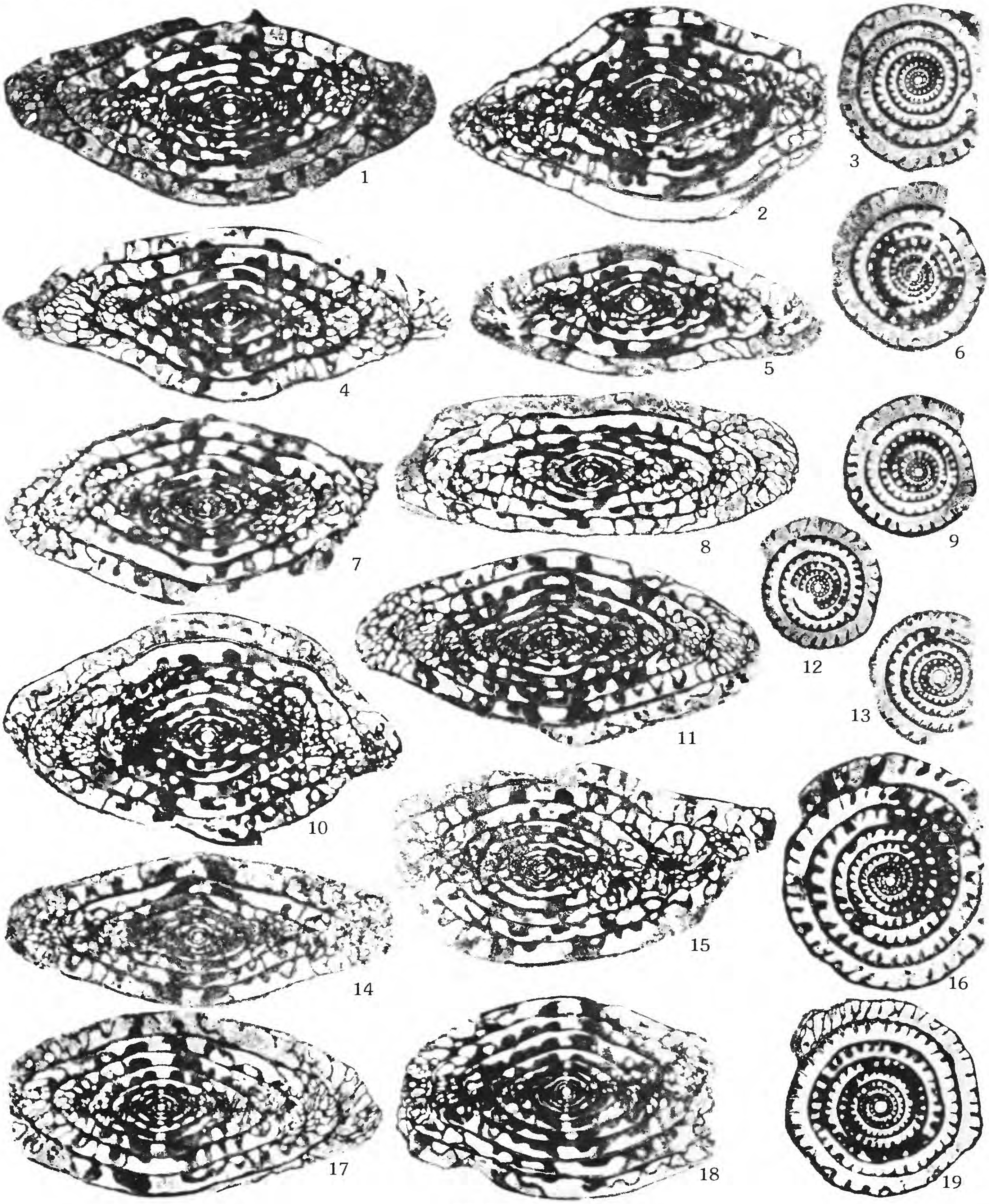
19. Equatorial section. Paratype, USNM 368862.

11–15. Specimens from locality 63, sample f14307.

11. Axial section. Paratype, USNM 368862.

12, 13. Equatorial sections. Paratypes, USNM 368855, 368856.

14, 15. Axial sections. Paratypes, USNM 368857, 368858.



BEEDEINA

PLATE 12

[All figures X20]

Figures 1–7. *Beedeina girtyi* (Dunbar and Condra), 1927 (p. 45) (see also pl. 13).

1–4. Specimens from Providence Limestone Member of Sturgis Formation at locality 27, sample f13785.

1. Axial section of unusually large specimen having 10 volutions. Hypotype, USNM 368863.
2. Equatorial section. Hypotype, USNM 368864.
3. Axial section. Hypotype, USNM 368865.
4. Axial section of microspheric specimen. Hypotype, USNM 368866.

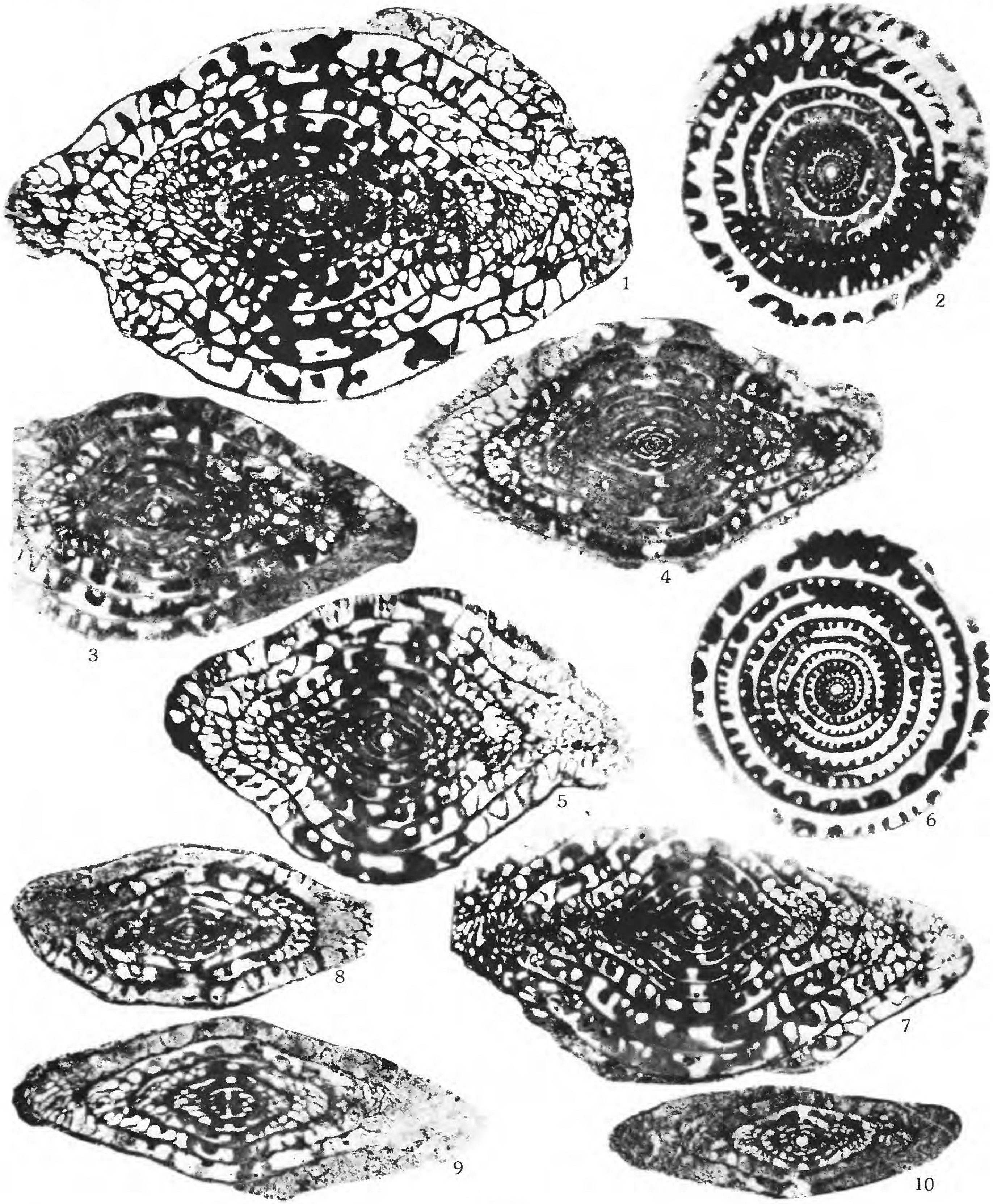
5–7. Reillustration of specimens from Herrin Limestone Member of Carbondale Formation in Illinois, illustrated by Dunbar and Henbest (1942, pl. 11).

5. Axial section of specimen illustrated by Dunbar and Henbest as fig. 11.
6. Equatorial section of paratype illustrated by Dunbar and Henbest as fig. 15.
7. Axial section of specimen illustrated by Dunbar and Henbest as fig. 14.

8–10. *Beedeina* sp. aff. *B. leei* (Skinner), 1931 (p. 40) (see also pl. 8).

Specimens from locality 39, sample f13906.

8. Axial section. USNM 368867.
9. Tangential section. USNM 368867A.
10. Axial section. USNM 368868.



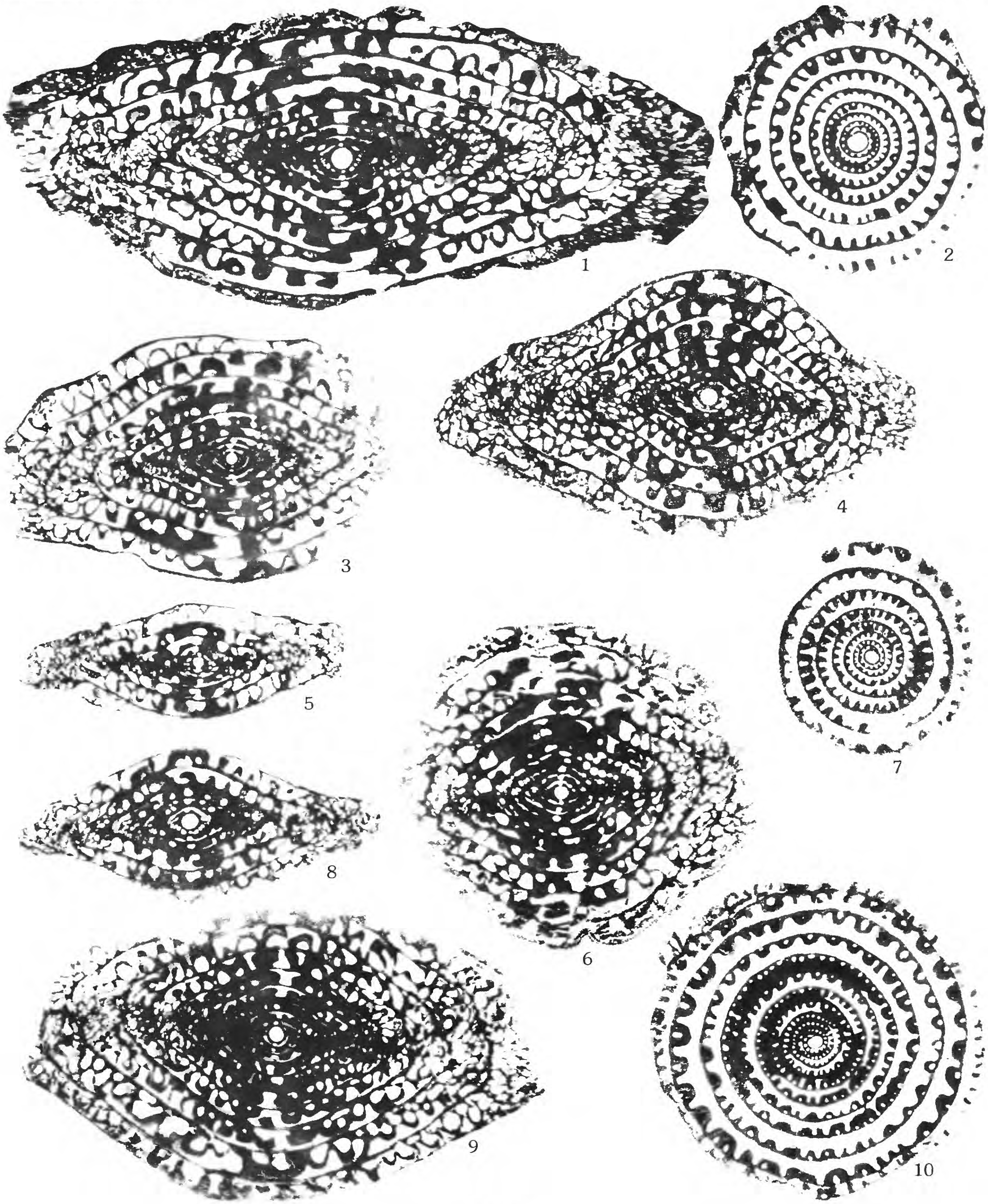
BEEDEINA

PLATE 13

[*Beedeina* from Providence Limestone Member of Sturgis Formation at locality 29 in Muhlenberg County, Ky.]

[All figures X20]

Figures 1–5, 7, 8. *Beedeina* sp. aff. *B. haworthi* (Beede), 1916 (p. 46).
1, 2, 4. Specimens from sample f13784.
1. Axial section of large elongate specimen. USNM 368869.
2. Equatorial section. USNM 368870.
4. Axial section of more fusiform specimen. USNM 368872.
3, 5, 7, 8. Specimens from sample f13783.
3. Incomplete axial section. USNM 368871.
5, 8. Axial sections of immature specimens. USNM 368873, 368876.
7. Equatorial section. USNM 368875.
6, 9, 10. *Beedeina girtyi* (Dunbar and Condra), 1927 (p. 45) (see also pl. 12).
Specimens from sample f13782.
6. Axial section of subrounded specimen. Hypotype, USNM 368874.
9. Axial section. Hypotype, USNM 368877.
10. Equatorial section. Hypotype, USNM 368878.



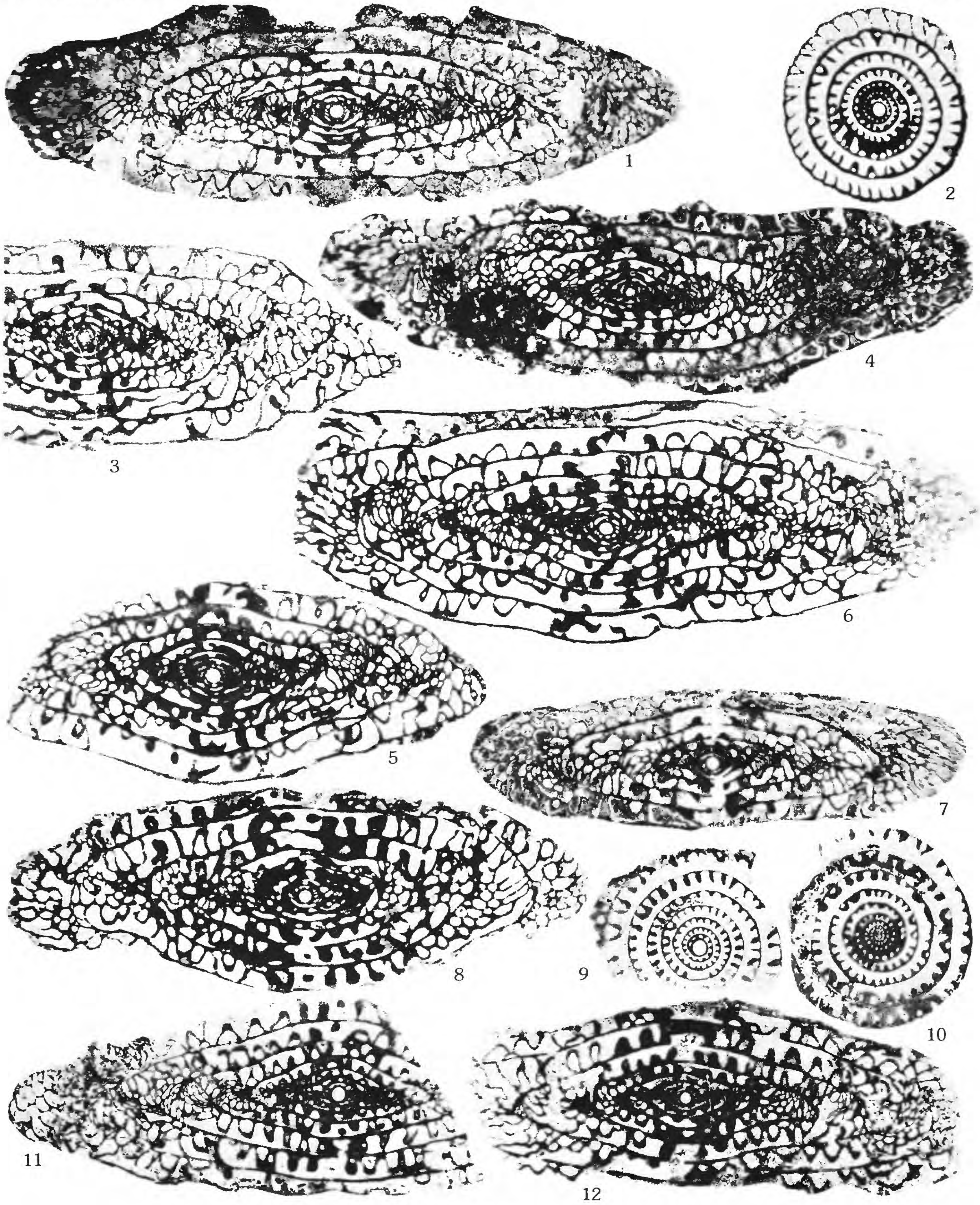
BEEDEINA

PLATE 14

[All figures X20]

Figures 1–7. *Beedeina acme* (Dunbar and Henbest), 1942 (p. 47).
Specimens from Madisonville Limestone Member of Sturgis Formation at locality 26, sample f13872.
1. Axial section Hypotype, USNM 368879.
2. Equatorial section. Hypotype, USNM 368880.
3–7. Axial sections, showing shape variation.
Hypotypes, USNM 368881–368885.

8–12. *Beedeina* sp. aff. *B. acme* (Dunbar and Henbest), 1942 (p. 49).
Specimens from Providence Limestone Member of Sturgis Formation at locality 28, sample f13874.
8. Axial section. USNM 368886.
9, 10. Equatorial sections. USNM 368887, 368888.
11, 12. Axial sections. USNM 368889, 368890.



BEEDEINA

PLATE 15

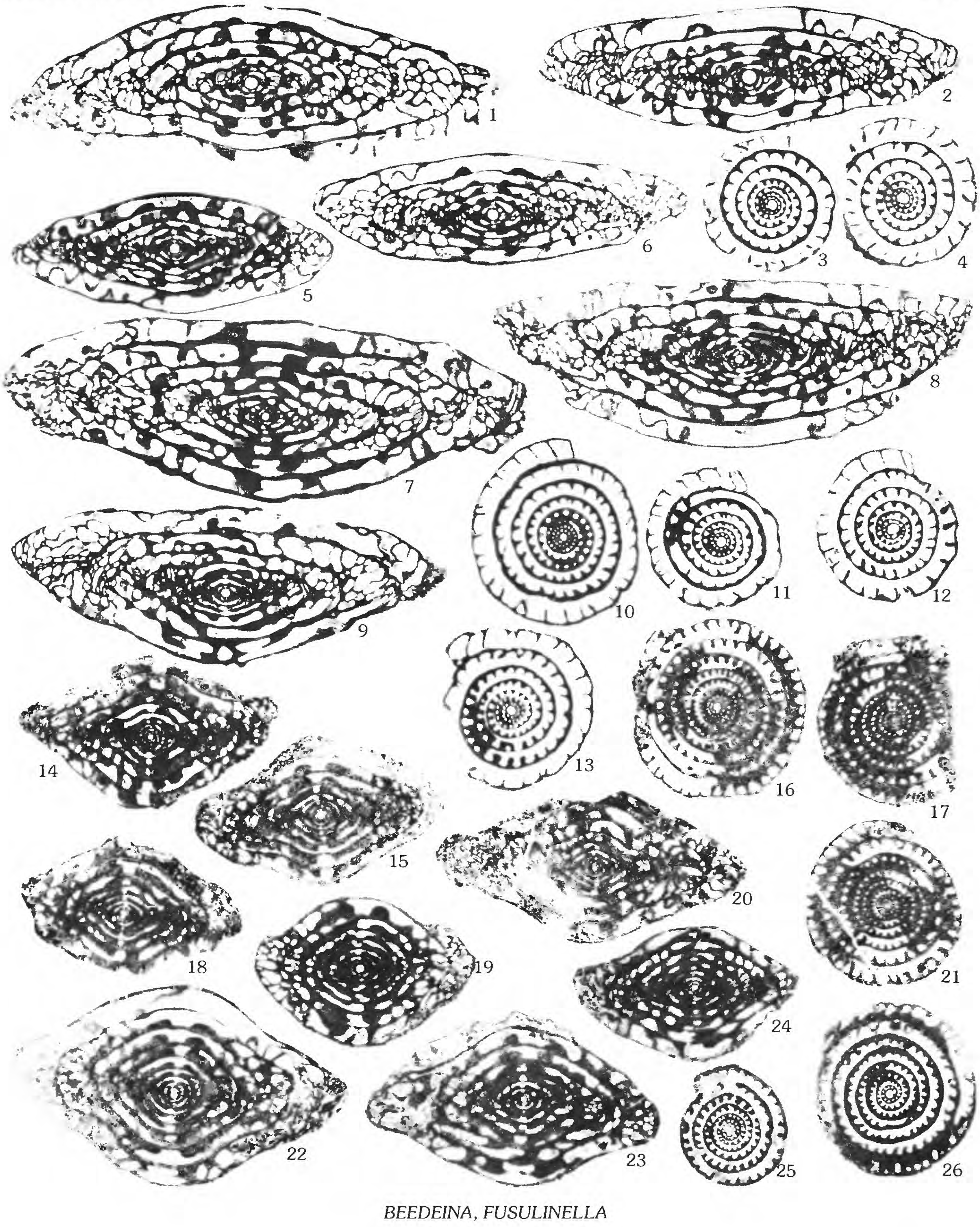
[*Beedeina* and *Fusulinella* from Ohio]

[All figures X20]

Figures 1–6. *Beedeina carmani* (Thompson), 1936 (p. 50).
- 1–4. Specimens from locality 75, sample f9717, in Vanport Limestone Member of Allegheny Formation.
  - 1, 2. Axial section. Topotypes, USNM 368891, 368892.
  - 3, 4. Equatorial sections. Typotypes, USNM 368893, 368894.
- 5, 6. Axial sections from locality 71, sample f13819, in Vanport Limestone Member. Hypotypes, USNM 368895, 368896.

7–13. *Beedeina leei* (Skinner), 1931 (p. 39) (see also pls. 8–10, 17).
- All specimens from locality 79 in Putnam Hill Limestone Member of Allegheny Formation.
- 7, 13. Specimens from sample f13837 near top of unit.
  - 7. Axial section. Hypotype, USNM 368897.
  - 13. Equatorial section. Hypotype, USNM 368903.
- 8–12. Specimens from sample f13841 in middle of unit.
  - 8, 9. Axial sections. Hypotypes, USNM 368898, 368899.
  - 10–12. Equatorial sections. Hypotypes, USNM 368900–368902.

14–26. *Fusulinella iowensis* Thompson, 1934 (p. 34) (see also pl. 6).
- 14–16. Specimens from locality 82, sample f9715, in upper Mercer Limestone Member of Pottsville Formation.
  - 14, 15. Axial sections. Hypotypes, USNM 368904, 368905.
  - 16. Equatorial section. Hypotype, USNM 368906.
- 17–21. Specimens from locality 74 from Mercer Limestone Member at Blunt Run.
  - 17, 18, 20, 21. Specimens from sample f13832 in upper limestone.
    - 17, 21. Equatorial sections. Hypotypes, USNM 368907, 368911.
    - 18, 20. Axial sections. Hypotypes, USNM 368908, 368910.
  - 19. Axial section from sample f13824. Hypotype, USNM 368909.
- 22. Axial section from locality 85, sample f13886. Hypotype, USNM 368912.
- 23. Axial section from locality 74, sample f13825. Hypotype, USNM 368913.
- 24, 25. Axial and equatorial sections from locality 76, sample f13816. Hypotypes, USNM 368914, 368915.
- 26. Equatorial section from locality 76, sample f13815. Hypotype, USNM 368916.



BEEDEINA, FUSULINELLA

PLATE 16

[*Triticites*, *Beedeina*, and *Wedekindellina* from Ohio]

Figures 1–10. *Triticites skinneri* Thompson, 1936 (p. 52).
All topotypes from locality 69, sample f9720, in Ames Limestone Member of Conemaugh Formation. All figures X10.
1–3, 7–9. Axial sections, showing variability of shape and coiling. USNM 368917–1368919, 368923–368925.
4–6, 10. Equatorial sections. USNM 368920–368922, 368926.

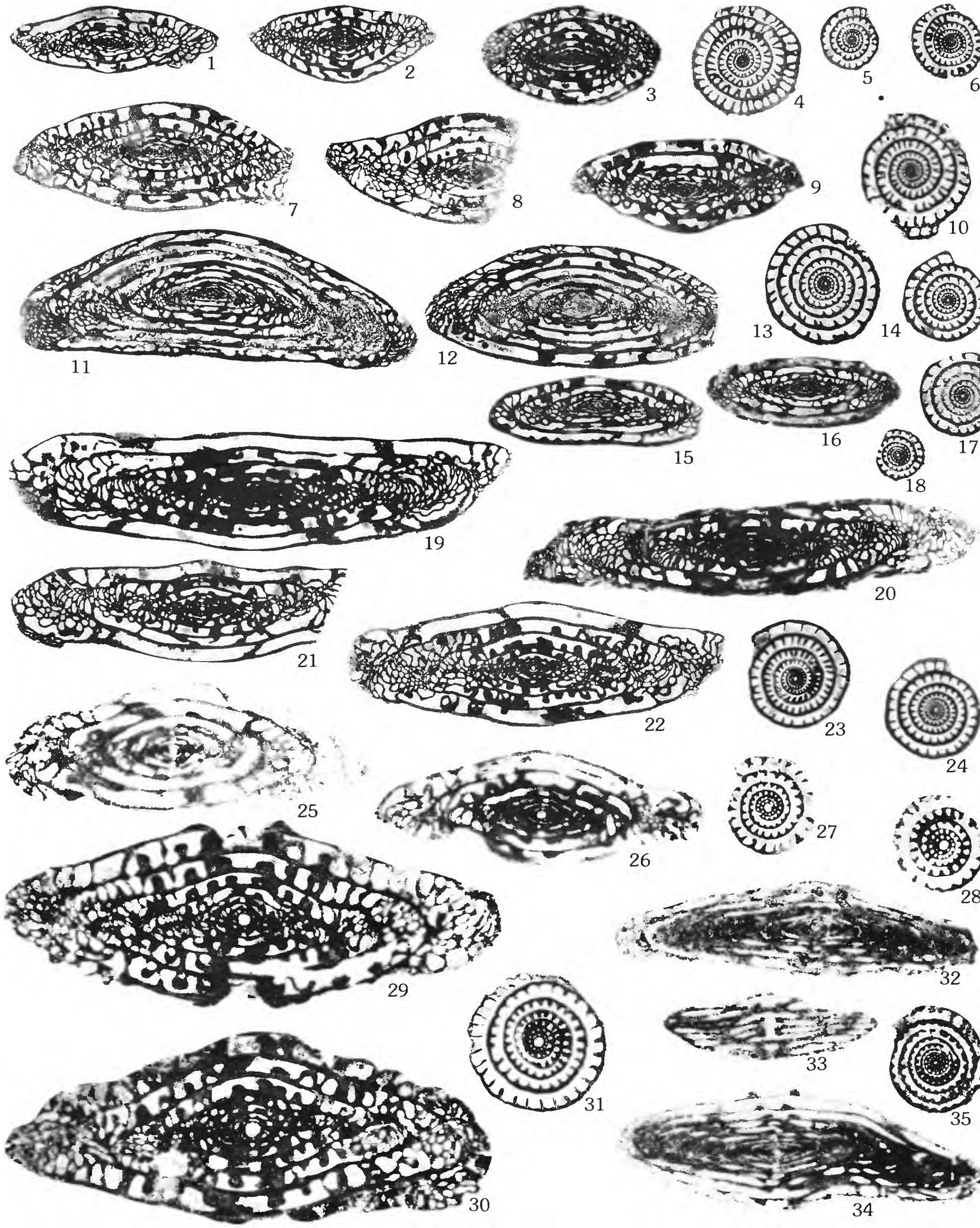
11–18. *Triticites ricei* Douglass n. sp. (p. 53)
All specimens from locality 66, sample f14005, in Ames Limestone Member. All figures X10.
11. Axial section. Holotype, USNM 368927.
12. Axial section. Paratype, USNM 368928.
13, 14, 17, 18. Equatorial sections. Paratypes, USNM 368929, 368930, 368933, 368934.
15, 16. Axial sections. Immature paratypes, USNM 368931, 368932.

19–24. *Triticites ohioensis* Thompson, 1936 (p. 55) (see also pl. 18). All figures X10.
19. Axial section of specimen illustrated by Thompson (1936, pl. 91, fig. 1), here designated lectotype. S.U.I. (State University of Iowa) 1044B.
20. Axial section of paralectotype illustrated by Thompson (1936, pl. 91, fig. 2). S.U.I. 1044A.
21–24. Specimens from locality 65, sample f13997, in Cambridge Limestone Member of Conemaugh Formation.
21, 22. Axial sections. Hypotypes, USNM 368935, 368936.
23, 24. Equatorial sections. Hyoptypes, USNM 368937, 368938.

25–28. *Triticites smythi* Douglass n. sp. (p. 57).
Specimens from locality 69, sample f9719, from Cambridge Limestone Member of Conemaugh Formation. All figures X20.
25. Axial section. Holotype, USNM 368939.
26. Axial section. Paratype, USNM 368940.
27–28. Equatorial sections. Paratypes, USNM 368941, 368942.

29–31. *Beedeina henbesti* Douglass n. sp. (p. 42).
Specimens from locality 83, sample f13109, from Vanport Limestone Member of Allegheny Formation. All figures X20.
29. Axial section. Holotype, USNM 368943.
30. Axial section. Paratype, USNM 368944.
31. Equatorial section. Paratype, USNM 368945.

32–35. *Wedekindellina euthysepta* (Henbest), 1928 (p. 36) (see also pl. 7).
Specimens from locality 83, sample f13109, from Vanport Limestone Member. All figures X20.
32. Axial section. Hypotype, USNM 368946.
33. Tangential section. Hypotype, USNM 368947.
34. Axial section. Hypotype, USNM 368948.
35. Equatorial section. Hypotype, USNM 368949.



TRITICITES, BEEDEINA, WEDEKINDELLINA

PLATE 17

Fusulinids from western Pennsylvania

Figures 1–4. *Triticites cullomensis* Dunbar and Condra, 1927 (p. 58).

Specimens from locality 88 at Brilliant Cut, Pittsburgh, Pa. All figures X10.

1, 2. Axial sections illustrated by Dunbar and Henbest, (1942, pl. 23, figs. 18, 17). YPM (Yale Peabody Museum) 16501.

3, 4. Axial and tangential sections of two additional specimens collected by William Darrah. Hypotypes USNM 368950, 368951.

5, 6, 16–23. *Beedeina* sp. (p. 51).

5, 6. Axial sections of probably immature specimens, X20, from locality 86, sample f13884, in float pieces of Vanport Limestone Member of Allegheny Formation. USNM 368952, 368953.

16–23. Specimens from locality 87, from the Mahoning Limestone of Rogers (1858), but representing Vanport Limestone Member of Allegheny Formation.

16, 17. Axial sections of probably immmature specimens, X20, from sample f13881. USNM 368963, 368964.

18. Axial section, X20, from sample f9111. USNM 368965.

19, 20. Axial section X20 and X50, sample f9111. USNM 368966.

21. Axial section of immature specimen, X20, sample f13881. USNM 368967.

22, 23. Axial section, X20 and X50, sample f9111. USNM 368968.

7–9. *Wedekindellina* sp. (p. 38).

Specimens from locality 86, sample f13884, in float pieces of Vanport Limestone Member of Allegheny Formation.

7, 9. Axial sections. USNM 368954, 368956.

8. Equatorial section. USNM 368955.

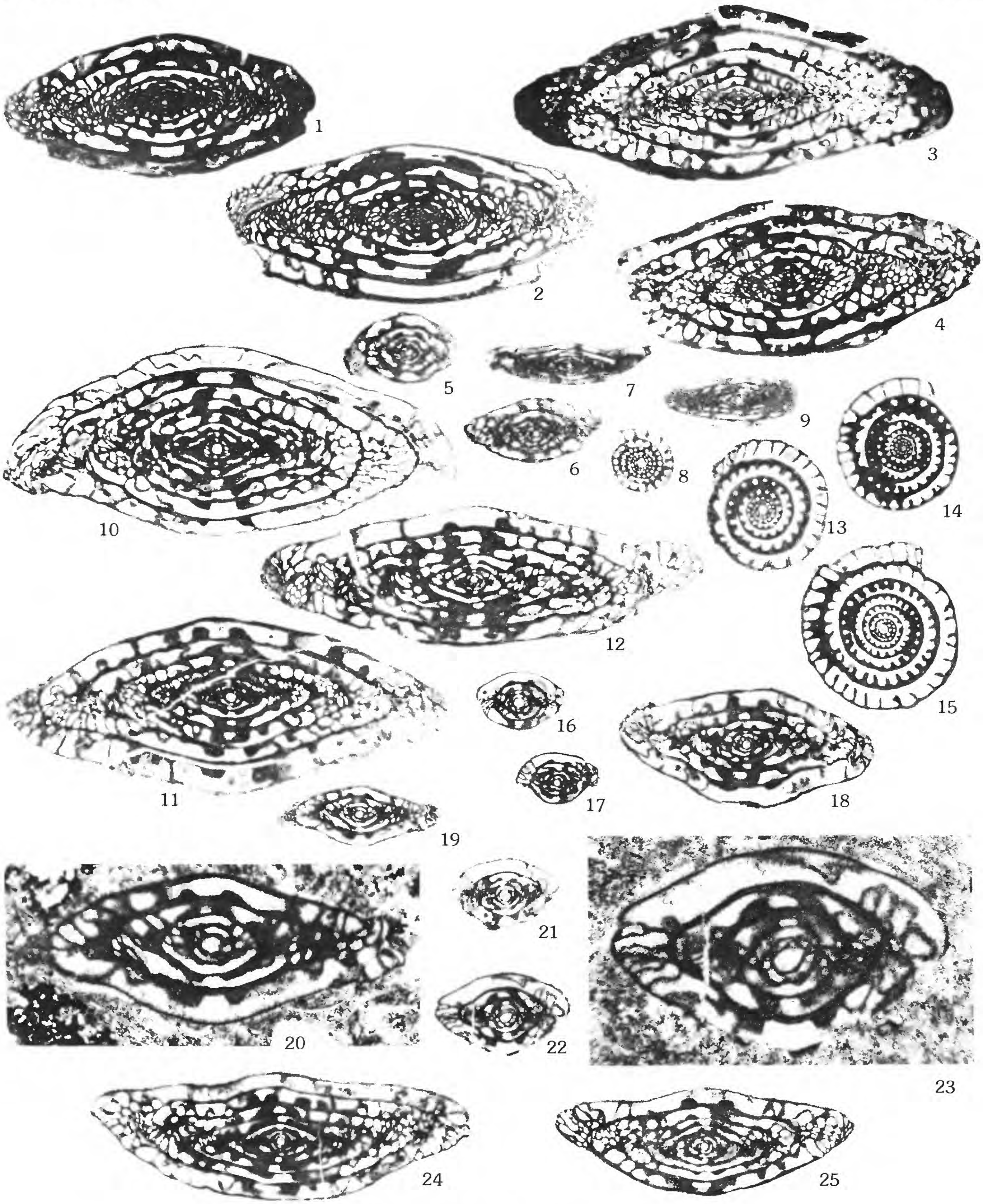
10–15, 24, 25. *Beedeina leei* (Skinner), 1931 (p. 39) (see also pls. 8–10, 15).

Specimens from locality 87, sample f13881, from the Mahoning Limestone of Rogers (1858), but representing Vanport Limestone member of Allegheny Formation. All figures X20.

10–12. Axial sections. Hypotypes, USNM 368957–368959.

13–15. Equatorial sections. Hypotypes, USNM 368960–368962.

24, 25. Axial sections. Hypotypes, USNM 368969, 368970.

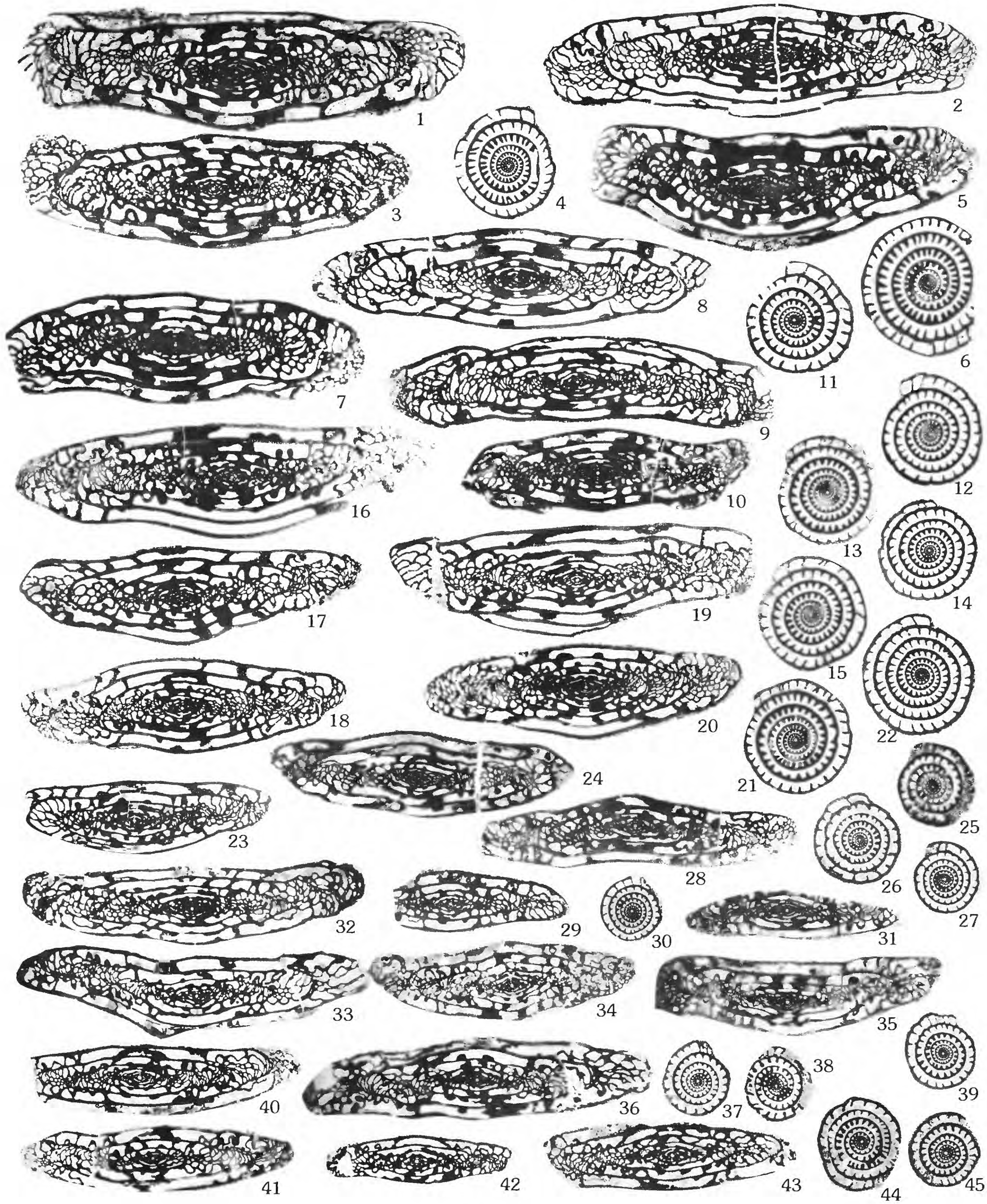


TRITICITES, BEEDEINA, WEDEKINDELLINA

PLATE 18

[All figures X20]

Figures 1–45. *Triticites ohioensis* Thompson, 1936 (p. 55) (see also pl. 16).
All specimens from Brush Creek Limestone Member of Conemaugh Formation, eastern Kentucky.
1–14. Specimens from locality 59, Boyd County.
1. Axial section from sample f13122.
Hypotype USNM 368971.
2–6. Specimens from sample f13120.
2, 3, 5. Axial sections. Hypotypes, USNM 368972, 368973, 368975.
4, 6. Equatorial sections. Hypotypes, USNM 368974, 368976.
7–14. Specimens from sample f24987.
7–10. Axial sections. Hypotypes USNM 368977–368980.
11–14. Equatorial sections. Hypotypes, USNM 368981–368984.
15–22. Specimens from locality 58, sample f14309, Boyd County.
15. Equatorial section. Hyoptype, USNM 368985.
16–20. Axial sections. Hyoptypes, USNM 368986–368990.
21, 22. Equatorial sections. Hyoptypes, USNM 368991, 368992.
23–31. Specimens from locality 56, Carter County.
23–27. Specimens from sample f13991.
23, 24. Axial sections. Hypotypes, USNM 368993, 368994.
25–27. Equatorial sections. Hypotypes, USNM 368995–368997.
28–31. Specimens from sample f13992.
28, 29, 31. Axial sections. Hypotypes, USNM 368998, 368999, 369001.
30. Equatorial section. Hypotype, USNM 369000.
32–39. Specimens from locality 57, sample f13584, Boyd County.
32–36. Axial sections. Hypotypes, USNM 369002–369006.
37–39. Equatorial sections. Hypotypes, USNM 369007–369009.
40–45. Specimens from locality 60, sample f14312, Boyd County.
40–43. Axial sections. Hypotypes, USNM 369010–369013.
44–45. Equatorial sections. Hypotypes, USNM 369014, 369015.



TRITICITES

PLATE 19

[All figures X10, except figures 9 and 11, X50]

Figures 1–11. *Triticites kehni* Douglass n. sp. (p. 59).

All specimens from Carthage Limestone Member of Sturgis Formation.

1–4. Specimens from locality 22, sample f13984.

1, 2. Axial sections. Paratypes, USNM 369016, 369017.

3. Equatorial section. Paratype, USNM 369018.

4. Axial section. Paratype, USNM 369019.

5–7. Specimens from locality 16, sample f13982.

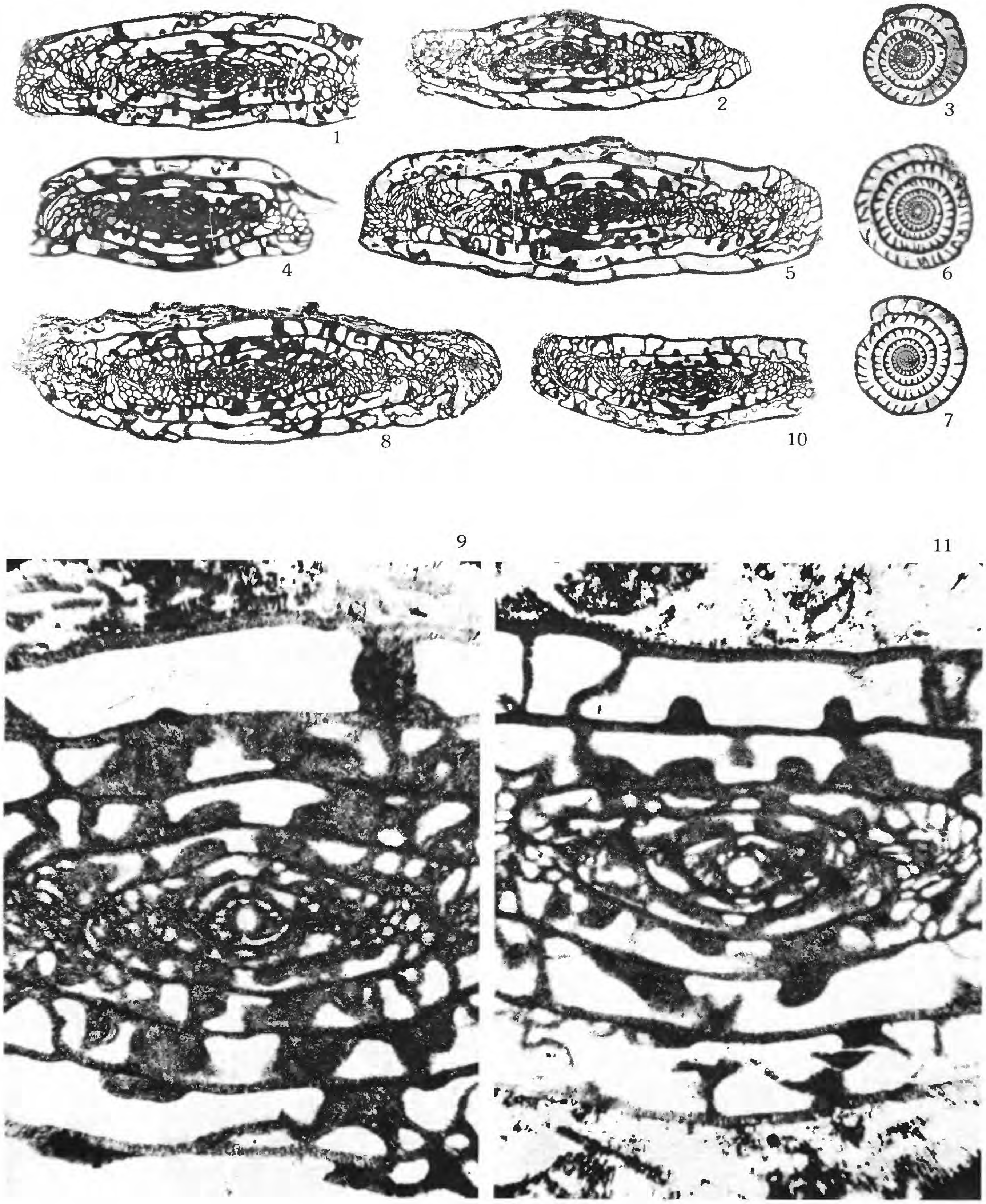
5. Axial section. Holotype, USNM 369020.

6, 7. Equatorial sections. Paratypes, USNM 369021, 369022.

8–11. Specimens from locality 22, sample f13977.

8, 9. Axial section. Paratype, USNM 369023.

10, 11. Axial section. Paratype, USNM 369024.



TRITICITES

PLATE 20

Triticites from Illinois and western Kentucky

Figures 1–3, 5, 6. *Triticites callosus* Dunbar and Henbest, 1942 (p. 60).
Specimens from locality 1, sample f13995; topotypes from Greenup Limestone Member of Matoon Formation. All figures X10.
1–3. Axial sections. Topotypes, USNM 369025–369027.
5, 6. Equatorial sections. Typotypes, USNM 369029, 369030.

4, 7–9. *Triticites mediocris* Dunbar and Henbest, 1942 (p. 61).
Specimens from locality 1. All figures X10.
4. Axial section from sample f13995 at type locality. Topotype, USNM 369028.
7. Axial section from sample f14013. USNM 369031.
8, 9. Equatorial and axial sections from sample f14012. Topotypes, USNM 369032, 369033.

10–15. *Triticites beardi* Douglass n. sp. (p. 62).
All specimens from locality 19, sample f13876, from unnamed bed of Early Permian age in the Mauzy Formation.
10–11. Partial axial section, X20 and X10. Paratype, USNM 369034.
12–13. Axial section, X20 and X10. Paratype, USNM 369035.
14–15. Axial section, X10 and X20. Holotype, USNM 369036.

TRITICITES