BIOSTRATIGRAPHY AND PALEOECOLOGY OF THE FLOYD SHALE, UPPER MISSISSIPPIAN, NORTHWEST GEORGIA

APPROVED:

[redacted]

This thesis is dedicated to my parents,

Barbara and Harry Broadhead.

BIOSTRATIGRAPHY AND PALEOECOLOGY OF THE FLOYD SHALE, UPPER MISSISSIPPIAN, NORTHWEST GEORGIA

by

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THESIS

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This thesis was submitted to the supervisory committee on August 12, 1974.

ABSTRACT

The Floyd Shale is a thick sequence of shale and siltstone containing minor units of sandstone and limestone that crops out in Georgia in the Valley and Ridge physiographic province. The formation represents the prodelta and embayment shale facies of high constructive deltas that were developed in the area during Late Mississippian time. Important facies associated with the Floyd Shale are the Hartselle delta front sandstone and the Tuscumbia, Monteagle, and Bangor shelf and carbonate bank limestones.

Paleontologic evidence suggests that the Floyd ranges in age from Middle Meramecan through Middle Chesteran, but the lowermost Floyd may possibly be Early Meramecan. Floyd deltas, fed from source areas to the south and east, prograded northwestward during the Middle and Late Meramecan over the Tuscumbia Limestone shelf. Delta abandonment during the Late Meramecan resulted in marine reworking of terrigenous facies and transgression by carbonate sediments of the Monteagle Limestone. In the Early and Middle Chesteran, deltas prograded to the north and west over the Monteagle Limestone shelf. Final delta destructive phases occurred in the Middle Chesteran culminating with the Bangor Limestone transgressive sequence.

During the period of Floyd deposition, communities of benthic marine organisms became established in sedimentary environments where favorable conditions prevailed. Five communities identified from the Floyd Shale may be distinguished on the basis of numerically dominant organisms; distribution can be related to sedimentary facies. Community 1 is dominated by linguloid brachiopods that probably inhabited areas of moderate to high sedimentation such as prodelta environments. Community 2 is dominated by mollusks and spiriferid and productid brachiopods and may have lived in shallow embayments established along strike from delta lobes. Community 3 includes assemblages dominated by fenestellid bryozoans that probably lived in shallow embayments similar to Community 2. Community 4 is dominated by pelmatozoan echinoderms, spiriferid brachiopods, and bryozoans and probably lived on the open shelf. Community 5 is characterized by dominant rugose or tabulate corals and pelmatozoan echinoderms that may have thrived on carbonate banks.

Previous studies of marine benthic communities by such authors as Bretsky and Anderson have suggested a rigid onshore to offshore shelf sequence to explain the distribution of communities. Lack of work on a larger scale has resulted in a gap in the "offshore" community of the Mississippian in Bretsky's (1969) chart. Community distributions proposed by these previous workers are an oversimplification that ignores the control of local sedimentary processes on the distribution

of marine organisms. The distribution of communities in the Floyd Shale explained in terms of depositional framework suggests that communities vary both perpendicular and parallel to the paleoshoreline depending upon sedimentary environment.

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INTRODUCTION

This study describes and interprets the paleontology of the Floyd Shale in northwest Georgia. Despite the large outcrop area and number of exposures, the Floyd has not previously been studied in detail, partly because complex structure and deep weathering have obscured many rock types in outcrop. Most studies of the Mississippian System in Georgia have dealt with the carbonate rocks of the Cumberland Plateau, which are better exposed and more suitable for petrologic and stratigraphic study.

The biostratigraphy of the Floyd provides documentation of the age of the formation, which may be useful in age correlation with the carbonate rocks to the northwest and with the type section of the Upper Mississippian in the Mississippi Valley. In particular, lower Meramecan faunas have not been reported from Georgia, and it is doubtful whether rocks of that age are present.

Paleoecologic examination of the Floyd Shale is directed to the relationship between benthic marine communities and sedimentary environments. From the distribution and composition of fossil communities in the Floyd Shale, I have attempted to develop a model for the deposition of the formation. I have also attempted to show that community distribution is controlled, at least in part, by depositional systems of terrigenous sediment; previous workers have correlated community distribution only with onshore to offshore shelf sequences.

Finally, the description and illustration of fossils from the Floyd Shale documents the occurrence of several genera and species not previously reported from the state of Georgia.

LOCATION AND ACCESSIBILITY

Rocks of the Floyd Shale examined for this study crop out in Catoosa, eastern Walker and Chattooga, western Whitfield and Gordon, and in Floyd and Polk Counties, northwest Georgia (Plate 1). Principal cities and towns in the area include Rome (Floyd County), Calhoun (Gordon County), and Ringgold (Catoosa County).

Important highways serving the area include Inter-State Highway 75, U. S. Highways 41, 441, and 11, and Georgia highways 143 and 20. Additional access is provided by large numbers of light-duty paved and gravel roads. Much of the outcrop belt of the Floyd is covered by farms and by pine and deciduous forests. Farming and lumbering are important industries in northwest Georgia, and some cities (e.g. Rome) have acquired several large, heavy industrial operations.

The climate is warm-temperate and moist. During the summer, temperatures range from 18°C to 32°C, and late afternoon and evening showers and thunderstorms are common. Large amounts of precipitation year-round may reduce many dirt roads to muddy, impassable mires, and contribute to the rapid weathering of rocks in the area.

METHODS

Sample sites were located on U. S. Geological Survey 7½' and 15' topographic quadrangle maps. Locality designations were derived from the county name, quadrangle designation (fig. 1), and number of the sample within that quadrangle and county (e.g. CH-2E-1 is the first locality examined in the part of Chattooga County that is in the Armuchee 7½' quadrangle). For sample designations from 7½' quadrangles, the first letter or two letters of the county name are used. Localities in 15' quadrangles are designated by the first letter of the quadrangle name and the locality number (e.g. C-1 is the first locality examined in the Calhoun 15' quadrangle).

The Floyd Shale has a low topographic relief (approximately 100 ft. or about 30 m.) and is exposed only in synclinal valleys where most of the outcrops are in roadcuts, but a few exposures occur in fields and quarries.

Rock types were noted and described in general terms in the field. Strike and dip measurements were not useful in estimating the thickness of the Floyd Shale because of the structural complexity within the formation.

Fossils were observed or collected at 134 of the 392 exposures of the Floyd Shale examined for this study. For convenience, I have regarded each exposure as a homogeneous

Figure 1. Index map of 7½' and 15' topographic quadrangle maps used in this study. The quadrangle name appears in the upper left of each box with the designation used herein in the middle, and the number of localities examined in the lower right.

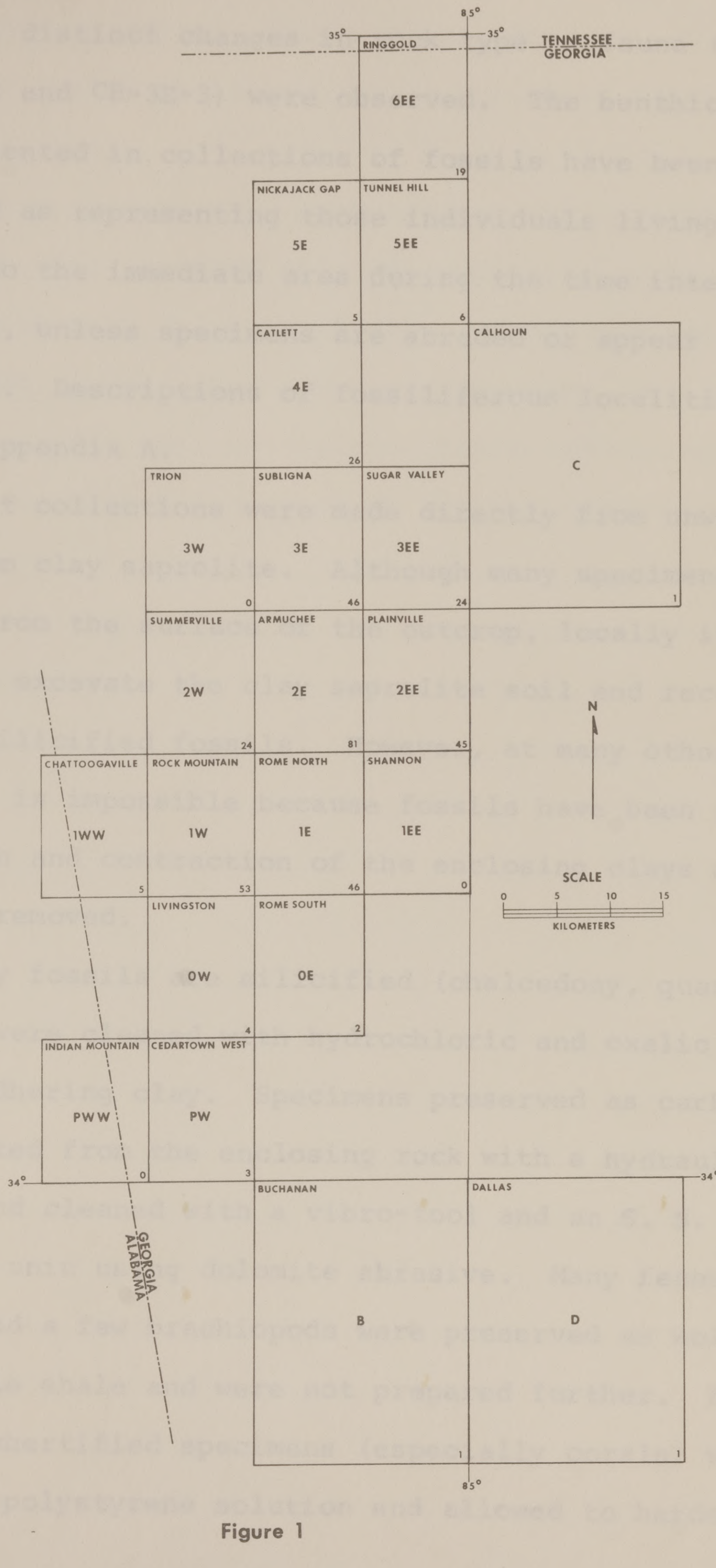

85°
35°
35°
TENNESSEE
GEORGIA
RINGGOLD
6EE
19
NICKAJACK GAP
TUNNEL HILL
5E
5EE
5
6
CATLETT
CALHOUN
4E
26
C
TRION
SUBLIGNA
SUGAR VALLEY
3W
3E
3EE
0
46
24
1
SUMMERVILLE
ARMUCHEE
PLAINVILLE
2W
2E
2EE
N
24
81
45
CHATTOOGAVILLE
ROCK MOUNTAIN
ROME NORTH
SHANNON
1WW
1W
1E
1EE
SCALE
0 5 10 15
KILOMETERS
5
53
46
0
LIVINGSTON
ROME SOUTH
0W
0E
4
2
INDIAN MOUNTAIN
CEDARTOWN WEST
PWW
PW
34°
0
3
BUCHANAN
DALLAS
34°
GEORGIA
ALABAMA
B
D
1
1
85°

Figure 1

unit unless distinct changes in rock type or fauna (as at CA-6EE-2, 3 and CH-3E-3) were observed. The benthic organisms represented in collections of fossils have been interpreted as representing those individuals living in or very near to the immediate area during the time interval represented, unless specimens are abraded or appear to be size sorted. Descriptions of fossiliferous localities are listed in Appendix A.

Most collections were made directly from unweathered rock or from clay saprolite. Although many specimens were collected from the surface of the outcrop, locally it is possible to excavate the clay saprolite soil and recover well preserved silicified fossils. However, at many other outcrops, this is impossible because fossils have been fractured by expansion and contraction of the enclosing clays and fall apart when removed.

Many fossils are silicified (chalcedony, quartz, or chert) and were cleaned with hydrochloric and oxalic acids to remove adhering clay. Specimens preserved as carbonate were extracted from the enclosing rock with a hydraulic core-splitter, and cleaned with a vibro-tool and an S. S. White Air-brasive unit using dolomite abrasive. Many fenestellid bryozoans and a few brachiopods were preserved as molds in soft, friable shale and were not prepared further. Brittle, weathered, chertified specimens (especially corals) were coated with polystyrene solution and allowed to harden before sectioning and grinding. This was not, however, as successful a method as embedding the specimens in plastic before sectioning.

Most specimens were prepared for photography by coating them with ammonium chloride sublimate using the method described by Teichert (1948). Ground and polished sections were photographed submersed in water, and carbonized plant remains were not treated before photography. Photographs in plates 2 through 16 are not retouched.

PREVIOUS WORK

The Floyd Shale was first defined by C. Willard Hayes (1891, pp. 142-143), who estimated its thickness at 2500 feet (approximately 760 m.) and assigned it a Carboniferous age. The first extensive geologic mapping that included the Floyd was done by Hayes in the Ringgold area (1894) and the Rome area (1902).

Little work was done on the Floyd Shale after that until Miller and Furnish (1940) reported the lower Chester goniatitic ammonoids Lyrogoniatites newsomi georgiensis Miller and Furnish and Girtyoceras meslerianum (Girty) from Floyd County. Butts and Gildersleeve (1948) discussed the Floyd, illustrated some fossils from it, and estimated the thickness at 1500 feet (approximately 456 m.). On their geologic map, they combined the Floyd and the underlying Fort Payne Formation into one map unit. Allen and Lester (1954) illustrated several invertebrate species from the Paleozoic rocks in northwest Georgia. The stratigraphic information given by Allen and Lester with their illustrations of Mississippian fossils suggests that they had used Butts' and Gildersleeve's map as a base for their study because they do not differentiate between Fort Payne and Floyd species.

Windham's (1956) study in the Ringgold area dealt primarily with the lithostratigraphy of the Mississippian System and indicated that rocks assigned to the Floyd there are approximately 410 feet (approximately 125 m.) thick. Faunal lists, however, are not supported by illustrations, and the only illustrated fossils are bryozoans and foraminifers, mostly unidentified. No references are given to support the identification of fossil species.

Work by Crawford (1956) in Polk County was the first recognition of the Floyd in that area. Correlation was made with the Floyd Shale because of the presence of molds of Lyrogoniatites newsomi georgiensis Miller and Furnish in siderite nodules similar to those locally common in the Floyd in Floyd County. Other fossils reported by Crawford include Bactrites? and the internal mold of a high-spired gastropod identified by him as Hormotoma sp. Crawford's photograph of Bactrites? shows a slightly distorted cylindrical form that looks like a burrow rather than a bactritid cephalopod, and the identification of the gastropod is unwarranted based on the internal mold assigned to a genus that is not known from rocks of Mississippian age.

Marquis (1958) studied the relationship of the Floyd and Fort Payne Formations in northwest Georgia, but his treatment of the Floyd Shale is little more than a description of rock types. He proposed that the "dark phase" (including shale and siltstone) of the Fort Payne be included in the Floyd (pp. 47-49), but this interpretation has not been accepted by later workers.

Detailed geologic mapping of the Paleozoic rocks in northwest Georgia was completed recently by Cressler (1963, 1964a, 1964b, 1970, 1974) in Catoosa, Walker, Chattooga, Floyd and Polk, and Whitfield and Gordon Counties, respectively. Formations and structures were mapped initially on 7½' and 15' topographic quadrangle maps, but the published maps are printed on county highway maps, which do not provide as satisfactory a base. In the report of Floyd and Polk Counties, Cressler (1970) illustrated several fossils from the Paleozoic rocks of the area, including a specimen of Goniatites sp. cf. G. kentuckiensis Miller from the Floyd Shale in Polk County (locality P-W-3).

Recent paleontologic studies in the Floyd have included brief reports by Cramer (1961) (Orbiculoidea and Petrocrania from Floyd County) and Lynch and Davis (1962) (unidentified straight nautiloid from Floyd County). Others include Broadhead and Bagby's work (1972) with inadunate crinoids from Floyd County and Broadhead's (1974) statistical study of Floyd Pentremites.

McLemore (1971) studied the geology and geochemistry of the Mississippian System in northwest Georgia and proposed that the Tuscumbia Limestone represents a transition from hypersaline environments for the cherty dolostones of the Fort Payne to a Bahaman Bank-Florida Bay type environment for the Monteagle Limestone (p. 103). In his study McLemore was unable to find any paleontologic evidence in the lower part of the Tuscumbia Limestone " . . . that could be used to determine whether these rocks are Warsaw-Salem equivalents" (p. 102). He regarded the Floyd as containing both deep and shallow water environments and stated that "a modern-day environment of a similar nature might be offshore areas of Louisiana and Texas in the Gulf of Mexico" (p. 120). Fossil lists in his work are quoted from other sources, particularly Butts and Gildersleeve (1948), Allen and Lester (1954), and Drahovzal (1967).

GENERAL GEOLOGY

The Floyd Shale of Meramecan and Chesteran age crops out in the Valley and Ridge physiographic province of southeast Tennessee, northwest Georgia, northeast Alabama, and in part of the Cumberland Plateau and Black Warrior Basin of northern Alabama. The formation was first described by Hayes (1891, pp. 142-143) and named for exposures in Floyd County, Georgia. The type locality is at or near a clay pit approximately 13.6 kilometers west of Rome, Georgia (McLemore, 1972, p. 93).

In Georgia, the Floyd Shale crops out principally in the Floyd Syncline (Butts and Gildersleeve, 1948, p. 60). This area is bounded on the east and south by the Rome Fault, on the north by Johns Mountain and Dick Ridge, and on the west by Taylor Ridge and Lavender Mountain. Other important exposures of the Floyd are in a large, doubly plunging syncline in Walker and Chattooga Counties that is bounded on the northwest by Taylor Ridge and on the east and south by Dick Ridge; a syncline in northern Catoosa County bounded on the west by Whiteoak Mountain (= Taylor Ridge to the south) and on the east and south by a normal fault. A syncline containing the Floyd Shale in western Floyd County is bounded on the north by Simms Mountain and on the south by a normal fault. Other exposures are in a small syncline in Catoosa, Walker, and Whitfield Counties and several in small synclines in Polk County, many of which are bounded on the south or southeast by small normal faults. One of the larger exposures of shale and slate in Polk County has been tentatively identified by Cressler (1970, p. 49) as Floyd Shale, and is truncated on the east and south by the Cartersville Fault, which separates Precambrian and Lower Paleozoic metamorphic rocks of the Blue Ridge from less deformed rocks of the Valley and Ridge Province.

The Floyd Shale includes a wide range of rock types, the most common being gray to brown, locally calcareous shale and siltstone (fig. 2) that may be structurally complex (fig. 3) and locally contain siderite nodules (fig. 4). Also present are fine-grained, red to brown sandstone and sandy siltstone (fig. 5), and gray, argillaceous and fine- to coarsely-crystalline limestone (fig. 6). In Polk County, low-grade regional metamorphism has altered many shale and siltstone beds to slate and phyllite (fig. 7).

In Georgia the Floyd Shale overlies the Fort Payne Formation, which is of Osage age (fig. 8). The Floyd is overlain by siltstone and sandstone of the Hartselle Sandstone, which ranges in thickness from about 10 ft. (3 m.) to 300 ft. (91 m.). Hayes (1902) believed that the Oxmoor and Hartselle Sandstones marked the top of the Floyd, but Butts (1926, p. 193) considered the Oxmoor to be part of the Hartselle. Cressler (1970, p. 48) suggested that the

Figure 2. Fossiliferous calcareous shale containing a Community 2 fauna at locality F-2E-3.

Figure 3. Folding in shale and siltstone at locality F-1W-28.

Figure 4. Siderite nodule (below hammer) at locality G-3EE-3.

Figure 5. Sandstone unit overlying bryozoan-bearing shale at locality CH-2W-16.

Figure 6. Thin limestone beds containing a Community 5 fauna overlying shale and overlain (in woods) by shale containing a Community 2? fauna at locality CH-3E-3.

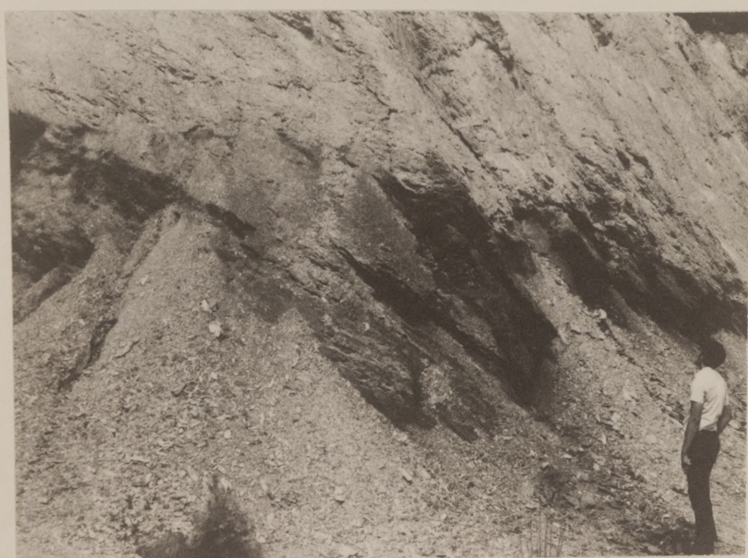


Figure 7. Phyllite and slate that contain siderite nodules with Lyrogoniatites at locality PW-3.

Figure 8. Time-stratigraphic and lithostratigraphic correlation chart showing generalized position of the Floyd Shale and its equivalents in Georgia as compared with formations in Alabama and the type Mississippian of Illinois. Generalized time-stratigraphic correlation is shown based on both the Mississippian and the European Carboniferous.

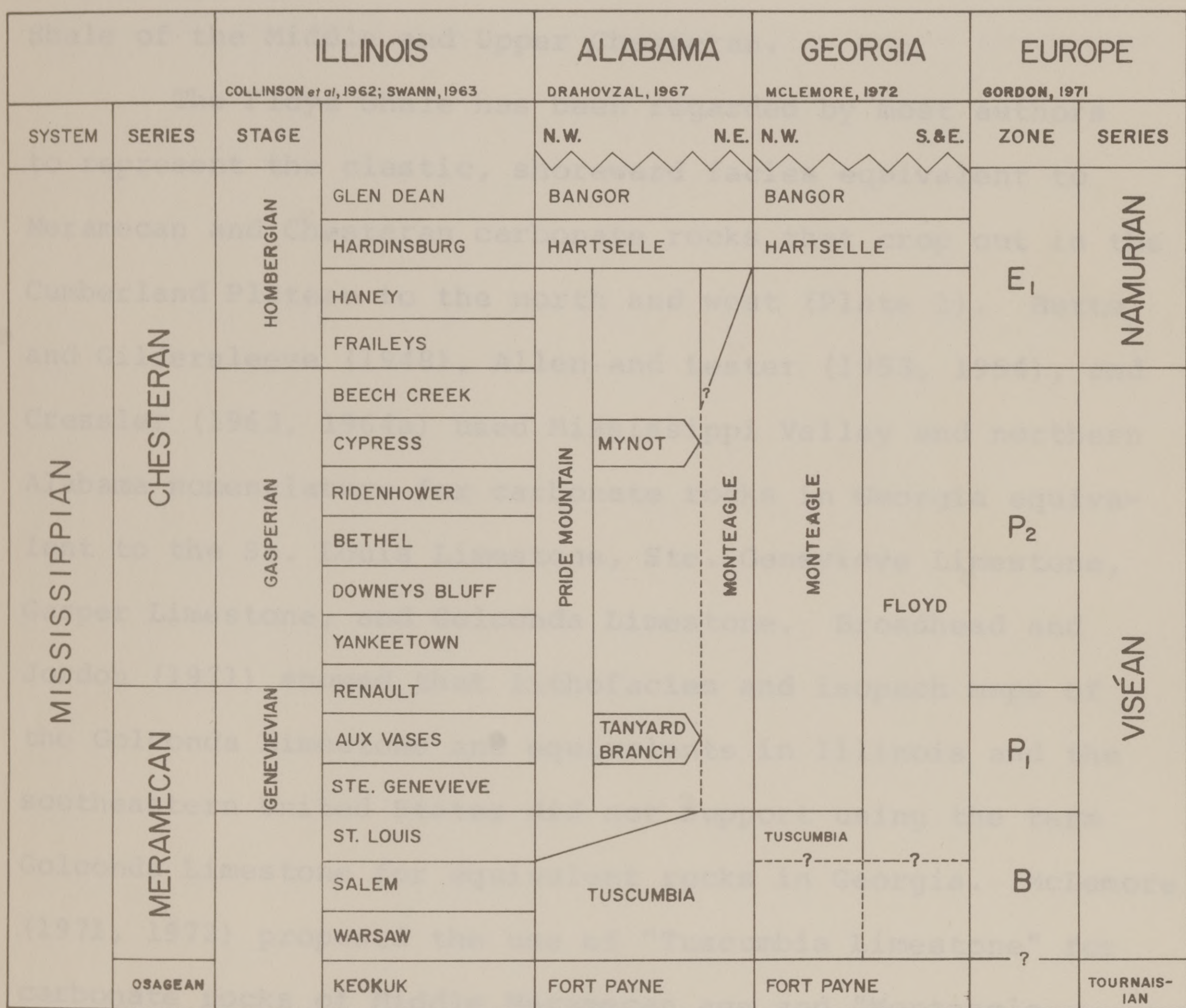

ILLINOIS
COLLINSON et al, 1962; SWANN, 1963
ALABAMA
DRAHOVZAL, 1967
GEORGIA
MCLEMORE, 1972
EUROPE
GORDON, 1971
SYSTEM
SERIES
STAGE
N.W.
N.E.
N.W.
S.&E.
ZONE
SERIES
MISSISSIPPIAN
CHESTERAN
MERAMECAN
OSAGEAN
HOMBERGIAN
GASPERIAN
GENEVIEVIAN
GLEN DEAN
HARDINSBURG
HANEY
FRAILEYS
BEECH CREEK
CYPRESS
RIDENHOWER
BETHEL
DOWNEYS BLUFF
YANKEETOWN
RENAULT
AUX VASES
STE. GENEVIEVE
ST. LOUIS
SALEM
WARSAW
KEOKUK
BANGOR
HARTSELLE
PRIDE MOUNTAIN
MYNOT
TANYARD BRANCH
MONTEAGLE
TUSCUMBIA
FORT PAYNE
BANGOR
HARTSELLE
MONTEAGLE
FLOYD
TUSCUMBIA
FORT PAYNE
E1
P2
P1
B
NAMURIAN
VISÉAN
TOURNAISIAN

Figure 8

Hartselle is a member of the Floyd because " . . . a considerable thickness of Floyd succeeds it" in Chattooga County, Georgia. In Alabama Thomas (1967) and Ferm and Ehrlich (1967) reported the Floyd to be a shale facies of the Hartselle Sandstone, Bangor Limestone, and Pennington Shale of the Middle and Upper Chesteran.

The Floyd Shale has been regarded by most authors to represent the clastic, shoreward facies equivalent to Meramecan and Chesteran carbonate rocks that crop out in the Cumberland Plateau to the north and west (Plate 1). Butts and Gildersleeve (1948), Allen and Lester (1953, 1954), and Cressler (1963, 1964a) used Mississippi Valley and northern Alabama nomenclature for carbonate rocks in Georgia equivalent to the St. Louis Limestone, Ste. Genevieve Limestone, Gasper Limestone, and Golconda Limestone. Broadhead and Jordon (1971) showed that lithofacies and isopach maps of the Golconda Limestone and equivalents in Illinois and the southeastern United States did not support using the term Golconda Limestone for equivalent rocks in Georgia. McLemore (1971, 1972) proposed the use of "Tuscumbia Limestone" for carbonate rocks of Middle Meramecan age and "Monteagle Limestone" for carbonate rocks of Late Meramecan and Early Chesteran age in Georgia. Both terms had been widely used in Alabama and Tennessee, and the two formations are generally differentiated by the presence of chert in the Tuscumbia, and the absence of chert and local abundance of oolites in the Monteagle. Tuscumbia and Monteagle are better suited names for the Cumberland Plateau region than are the Mississippi Valley names. Rocks in this area of Middle Chesteran age (Golconda Group equivalents) should be assigned to the Monteagle if the local lithotype is limestone, and to the Hartselle if it is siltstone or sandstone.

DEPOSITIONAL ENVIRONMENT

The sediment source of the Floyd Shale was probably a land area to the east and south of the marine basin. Sediments were probably fluvially transported to the marine environment where deposition resulted in the irregular progradation of the shoreline. This, according to Fisher et al. (1969, p. 14), is basically the definition of a delta.

The large volume of terrigenous clastic sediment that constitutes the Floyd Shale suggests that deltas responsible for Floyd deposition were of the "high-constructive" type. Two basic types of high-constructive deltas (Fisher et al., ibid) are (1) high-constructive elongate, which "develop under conditions of high sediment input relative to marine reservoir energy, with sediment load high in mud, and with sand facies prograding over relatively thick mud sequences," and (2) high-constructive lobate, which "develop under conditions of high sediment input but with relatively less mud load, and generally with sand facies prograding over thin mud sequences."

The basic component facies of a high-constructive delta during the constructional phase have been summarized by Fisher et al. (op cit, pp. 15-19). At the base of the delta sequence and at the distal end of the facies tract is the prodelta facies, composed of clay and silt, which settle from suspension. Overlying and geographically landward of the prodelta is the delta front, composed primarily of sand deposited by rivers flowing into the marine basin. The proximal, or landward part of the delta front consists of the distributary channel, distributary mouth bar, and distal bar. The distal, or seaward part of the delta front consists of marine reworked sheet sands that have been "spilled out" from the distributaries onto the prodelta. The vertical delta sequence coarsens upward in grain size from the clay and silt of the prodelta into the fine and medium sand of the delta front. Landward from the delta front, and overlying it in the vertical sequence, is the commonly extensive delta plain facies. The delta plain is mostly subaerially exposed and includes several component facies, including subaerial levees, distributary channels, marshes, and lakes.

During the destruction of abandoned deltas the rate of sedimentation is drastically reduced, and the dominant processes affecting sediments are those related to marine influence. Fisher _et al_. (op cit, p. 19) reported that on abandonment,

> . . . the prodelta area reverts to a normal shelf facies, marked by a much slower rate of deposition, and inhabited by a larger number of marine organisms. Delta front sands accumulate in shallow areas so that they are extensively reworked by waves and other marine processes when the locus of deltation is shifted and lobal abandonment occurs.

In Georgia, the Floyd Shale is gradationally overlain by the Hartselle Sandstone (Hartselle Sandstone Member of the

Floyd Shale of Cressler, 1970). The gradational contact of the Floyd and Hartselle strongly suggests a genetic relationship between the two formations based on the model described above. In the western part of Floyd County (south ½ of 1W) at Judy Mountain, Cressler (1970, p. 48) described the Hartselle as

> . . . about 300 feet [91 m.] thick and consists of light to medium gray, thinly to massively bedded very fine-to-medium-graded sandstone and quartzite. Siltstone and quartz-pebble conglomerate also make up an important part of the formation. Siltstone is especially common near the base.

At Rocky Mountain (north ½ of 1W), Cressler (ibid) stated that

> . . . the Hartselle ranges in thickness from about 50 feet to 200 feet [15 to 60 m.]. It is thin bedded, generally 6 inches to 1 foot [15 to 30 cm.] thick, and is very fine-to-medium-grained sandstone and siltstone.

In the carbonate facies of the Cumberland Plateau to the northwest Butts and Gildersleeve (1948, p. 48) have reported the Hartselle to be "5 to 10 feet [1.5 to 3 m.] of sandstone or sandy limestone that weathers to sandstone."

Ferm and Ehrlich (1967, p. 13) considered the Floyd Shale in Alabama to represent delta front and prodelta facies. McLemore (1972, p. 73) agreed with Ferm and Ehrlich, but stated that in Georgia:

> . . . the great thickness and lack of shallow water sedimentary structures (ripple marks, mud cracks, etc.) seem to indicate that the Floyd was deposited rather rapidly in deeper waters. The carbonaceous material and paucity of fossils appear to indicate that the general depositional environment was unfavorable to benthonic life and probably reducing.

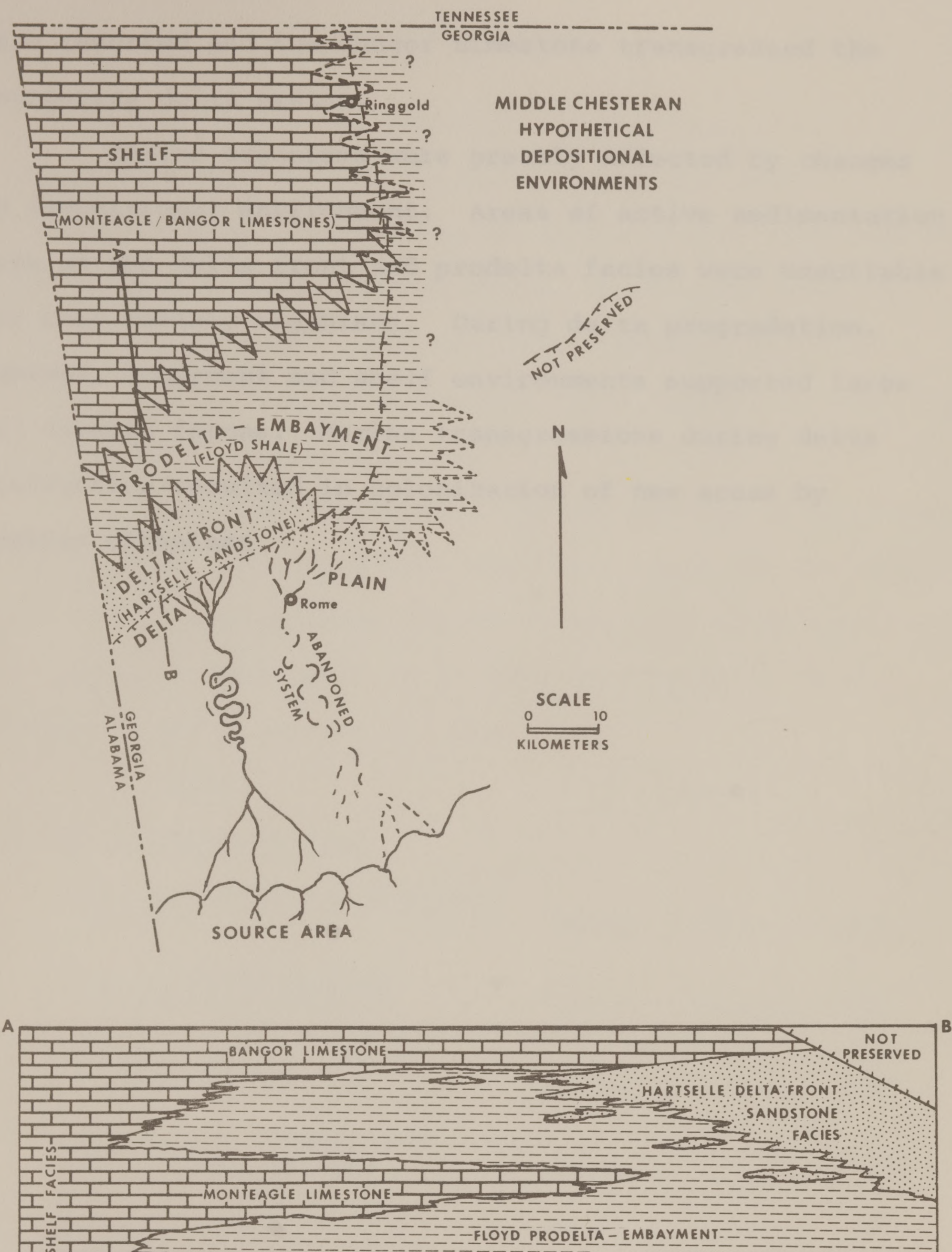
McLemore's analysis seems to confirm Ferm and Ehrlich's interpretation. However, the absence of shallow water sedimentary structures in most Floyd outcrops does not necessarily preclude deposition in shallow water. Bioturbation during periods of low sedimentation may disrupt current and oscillation ripples in the delta front. Small cross beds may form in the proximal prodelta facies (Fisher *et al*., 1969, p. 18), but these may be disrupted near the surface by burrowing organisms during quiescent periods. Ripples were observed at one locality (CH-2W-20), but mud cracks should not be expected in the delta front or prodelta because these facies are not subjected to subaerial exposure.

Abundant carbonaceous material and low faunal abundance and diversity are characteristic of prodelta mudstones and have been well documented from Pennsylvanian rocks of north-central Texas (Galloway & Brown, 1972; Brown *et al*., 1973; Erxleben, 1974). At many localities the Floyd is dark gray to black shale and siltstone that are unfossiliferous or contain only a few broken fragments of echinoderms and articulate brachiopods or locally abundant linguloid brachiopods. Reducing conditions commonly associated with prodelta facies are indicated in the Floyd by locally common siderite and pyrite nodules and limonite boxworks probably derived from the weathering of iron sulfides. An important component of several of the siderite-pyrite nodules is the abundance of goniatitic ammonoids and terrestrial plant fragments in excellent states of preservation. This phenomenon is similar to that in the Fayetteville Shale of Arkansas described by Zangerl (1971), in which siderite nodules nucleated about decaying organic material. Most fossils in nodules from the Floyd are highly motile or easily transported types; very few benthic fossils were observed in this environment.

Nonetheless, at numerous localities in the Floyd Shale, there are rocks ranging from siltstone to limestone that are very fossiliferous. It is unlikely, based on the models mentioned above, that these are directly related to deltaic progradation. Rather, they may represent interdeltaic, lagoonal, shelf, or carbonate bank deposits similar to those in the Pennsylvanian of north-central Texas (Brown, 1969; Galloway and Brown, 1972; and Brown et al., 1973). Toward the north and west, particularly in Catoosa County, great thicknesses of the Tuscumbia and Monteagle Limestones may represent shelf and bank carbonate rocks deposited in areas of low terrigenous influx. The local abundance of tabulate and rugose corals in this area indicates that water depth probably did not exceed 50 meters (Wells, 1957, p. 774).

The lack of extensive sandstone units in the pre-Hartselle Floyd Shale in Georgia makes the interpretation of the genesis and depositional environment of the formation difficult, particularly if the interpretation is restricted to the shale unit only. Cressler's (1970, p. 48) description of the overlying Hartselle Sandstone suggests that it may be gradational with the Floyd Shale; that is, the Floyd-Hartselle constitutes a coarsening upward sequence. This strongly suggests that the Floyd, in part, represents a prodelta facies and that, at least in part, the Hartselle may represent a delta front facies. Rocks in or above the Hartselle that may be construed as delta plain or distributary facies have not been recognized in Georgia, and may have been removed by erosion. It is, however, probable that delta plain facies once existed to the southeast along a facies tract typical of delta systems.

The general depositional history of the Floyd Shale and associated contemporaneous facies may be summarized as follows: (*see also* fig. 9). Delta progradation began initially during the Meramec, contemporaneous with deposition of the Tuscumbia Limestone on a shelf area to the northwest. During the Late Meramec and Early Chester, deltas, temporarily abandoned, underwent destruction by marine processes resulting in deposition of the transgressive Monteagle Limestone. Progradation in the area began again during the Early Chester and continued through the Middle Chester when Floyd deltas appear to have reached their maximum geographic extent. Following abandonment, destructional phases occurred again towards the end of the Middle Chester and continued into the Late Chester, during which time delta front Hartselle sands



DIAGRAMATIC (NO SCALE) SECTION OF UPPER MISSISSIPPIAN ROCKS IN GEORGIA
DERIVED IN PART FROM CRESSLER, 1970; MCLEMORE, 1972

Figure 9

were reworked and the Bangor Limestone transgressed the foundering delta system.

Marine organisms were greatly affected by changes in depositional environment. Areas of active sedimentation such as the delta front and prodelta facies were unsuitable for many benthic organisms. During delta progradation, however, embayment and shelf environments supported large and diverse faunas. Marine transgressions during delta destruction resulted in colonization of new areas by benthic organisms.

BIOSTRATIGRAPHY

Hayes (1891, pp. 142-143) first suggested a Carboniferous age for the Floyd Shale. Butts and Gildersleeve (1948, p. 42) stated that a hiatus representing the Warsaw Limestone interval exists in Georgia above the Fort Payne Formation. More recently, McLemore (1971, p. 102) was unable to find Warsaw and Salem fossils in the lower Tuscumbia Limestone in Georgia.

To describe the biostratigraphy and age of the Floyd Shale, I have identified from the Floyd Shale the following brachiopods, echinoderms, rugose corals, and cephalopods that are generally considered to be good stratigraphic index fossils in the Meramecan and Chesteran:

Fossil	Source
Chester undifferentiated	
Cleiothyridina sublamellosa (Hall)	Carter & Carter, 1970
Reticulariina spinosa (Norwood & Pratten)	Carter & Carter, 1970
Spirifer leidyi Norwood & Pratten	Carter & Carter, 1970
Pentremites (_godoni_ and _pyriformis_ groups)	Galloway & Kaska, 1957
Agassizocrinus	Moore & Strimple, 1973
Zeacrinites	Moore & Strimple, 1973
Middle Chester	
Cravenoceras	Furnish, _et al._, 1971
Tylonautilus	Miller & Furnish, 1955

Lower Chester

Talarocrinus	Butts & Gildersleeve, 1948
Lyrogoniatites	Furnish, et al., 1971
Neoglyphioceras	Furnish, et al., 1971

Meramec

Cystelasma	Bassler, 1950
Lithostrotionella	Bassler, 1950
Lithostrotion proliferum (Hall)	Bassler, 1950
Perditocardinia dubia (Hall)	Carter & Carter, 1970
Forbesiocrinus	Moore & Strimple, 1973

The primary problem associated with correlation based on species is the ability to correctly recognize the appropriate species. In this study, the greatest potential problem is probably the identification of Cleiothyridina sublamellosa (Hall). Weller (1914, p. 480) compared this species with C. hirsuta (Hall), claiming that the primary differences between the two are subequal convexity of the valves and smaller size in C. hirsuta versus a more strongly convex brachial valve and larger size in C. sublamellosa. C. hirsuta is regarded as a Meramecan (Warsaw through Ste. Genevieve) species, whereas C. sublamellosa is restricted to the Chester and above (Carter & Carter, 1970, p. 49). Weller further suggested that young individuals of C. sublamellosa may be very similar to C. hirsuta. I believe that all specimens of Cleiothryidina that I have observed in the Floyd Shale belong in _C. sublamellosa_, but this species may be a poor index fossil for the Chester because of the difficulty in separating it from _C. hirsuta_.

Of all fossiliferous localities in the Floyd Shale, 55 appear to be of Chesteran age. At many localities there are several Chesteran fossils listed above, but at a few others the age determination has been made on the presence of a single genus or species. Lower Chesteran fossils are present at 12 of the 55 localities, and Middle Chesteran taxa are present at 4.

Another problem in correlation is the presence of fossils referred to different ages in the same outcrop. In the Floyd Shale the most common occurrences of this situation are the presence of both Chesteran and Meramecan (commonly Upper Meramecan) fossils. In these collections, a detailed interpretation of the age is usually impossible. At locality F-2E-3 an assemblage containing abundant mollusks includes both the Lower Chesteran goniatite _Lyrogoniatites_ and the Middle Chesteran goniatite _Cravenoceras_ plus the nautiloid _Tylonautilus_. This association may be interpreted as occurring very near to the Lower Chester-Middle Chester boundary as it contains characteristic fossils of both stages.

Of the remaining localities 7 appear to be of Meramecan age. Another 14 localities contain both Chesteran and Meramecan index fossils, although there are commonly more

Chesteran than Meramecan types. Among the common Meramecan fossils are the lithostrotionid corals, which many previous authors (e.g. Butts & Gildersleeve, 1948) believed were good index fossils to the Meramec (especially the St. Louis Limestone). However, Butts and Gildersleeve (1948, p. 51) reported the occurrence of what they believed to be a coral that was very similar to Lithostrotionella castelnaui (Yabe & Hayasaka), (which has recently been placed in synonymy with Acrocyathus floriformis d'Orbigny) by Easton (1973) from the Gasper Limestone (Lower Chester) in Georgia. At least 4 collections I have made that contain lithostrotionid corals appear to be more like faunas of the Chester than those of the Meramec. Thus, the lithostrotionids may not be such good guides to the Meramec as previously supposed.

In the Tuscumbia Limestone of Alabama Drahovzal (1967, pp. 14-15) reported several characteristic species that are believed to be index fossils of the Warsaw Limestone (Lower Meramec). Among his species were Spirifer bifurcatus Hall, S. Lateralis Hall, and Pentremites conoideus Hall. None of these species had previously been reported from Georgia and none were observed during this study. The only evidence I have found for correlation of the Floyd Shale with the Warsaw Limestone is one large, inflated interbrachial plate of a large flexible crinoid (CH-2E-17) that resembles interbrachial plates of Forbesiocrinus saffordi Hall, a Warsaw Limestone species. However, definite identification is impossible from such fragmentary evidence. Recently, Robert Bolding of Rome, Georgia, (personal communication) has reported finding a specimen of *Spirifer* sp. cf. *S. lateralis*, but this occurrence needs to be examined thoroughly for other evidence that would suggest a Warsaw age.

Bassler (1950, pp. 217-218) listed species of the small rugose coral *Cystelasma* from the Salem and Ste. Genevieve Limestones. Another common Meramecan form is the brachiopod *Perditocardinia dubia*. Both of these fossils have been reported to be common in the Salem Limestone, but are also present in rocks as young as the Ste. Genevieve Limestone. Only 3 localities in the Floyd Shale contain one or both of these fossils without any inferred Chesteran forms. The brachiopod is present at all three localities but the coral is found only at locality WA-4E-8. Again, it is not possible to make a definite correlation, but these three Floyd Shale localities may be the same age as the Salem Limestone. The remaining Meramecan localities are assumed to be equivalent to the St. Louis or Ste. Genevieve Limestones.

The Monteagle Limestone has been correlated with the Upper Meramecan (Ste. Genevieve Limestone) through the Lower Chesteran (Drahovzal, 1967, p. 15). The Bangor Limestone, which overlies the Hartselle Sandstone, has been correlated with the Glen Dean Limestone of the Mississippi Valley (Drahovzal, 1967, p. 19), implying an upper age limit for the Floyd Shale of Middle Chesteran (probably Haney Limestone equivalent) (fig. 8). Faunas at 4 localities in the Floyd Shale of Georgia contain cephalopods characteristic of rocks equivalent to the Haney, supporting this correlation.

Most of the fossils collected from the Floyd Shale are long-ranging species and genera that are not useful for biostratigraphic work. Fossils from the Floyd indicate a lower age limit equivalent to the Salem Limestone of Illinois, but do not preclude the presence of rocks the same age as the underlying Warsaw Limestone. Cephalopods collected near the top of the Floyd indicate that deposition of the formation continued into the Middle Chester. Mixed faunas collected at several localities are interpreted as representing periods of time at or near the boundaries which they have purportedly defined (e.g. Upper Meramec-Lower Chester).

PALEOECOLOGY

Introduction to Benthic Community Studies

The concept of benthic marine communities is attributed to C. G. J. Petersen (1913) for his work off the coast of Denmark. Petersen's intention was

> . . . to procure a series of quantitative samples of the more common larger animals of the sea bottom, and to use the figures obtained for a calculation of the quantity of fishfood available for bottom fish (especially flounders) living in the same seas (Thorson, 1957, p. 467).

As Thorson stated, "Petersen had no intention of describing animal communities when he started his survey but wanted to obtain an idea of the statistical distribution of the animals" (ibid.). Nonetheless, he observed widespread distribution of similar groups of animals that characterized different physical environments by their presence and/or relative abundance.

Petersen's communities (Petersen Animal Communities or PAC's of Watkins *et al.*, 1973) were based on benthic species, but Thorson (1957) found that communities defined at higher taxonomic levels (e.g. genus and family) could be observed over a larger geographic range in similar physical conditions. These "Paralled Communities" have the advantage of "describing an ecologic unit of greater areal and temporal scale than the PAC" (Watkins *et al.*, 1973, p. 56). This provides easier comparison of communities because of maintenance of higher taxa through time and adaptations of species geographically.

Application of the community concepts of Petersen and Thorson to the fossil record is best known from the studies of Ziegler (1965, 1970) and Bretsky (1968, 1969a, 1969b). The communities of these authors are not easily classified either as PAC's or Parallel Communities; identification of communities based on genera suggests Parallel Communities, but relatively low diversity at any exposure may indicate locally defined PAC's from which Parallel Communities were derived.

Bretsky (1968, 1969b) has further summarized the organization of Paleozoic communities from works of other authors. He has grouped communities into general "associations" representing what is probably an oversimplified onshore to offshore transition of shelf faunas (fig. 10).

For the Mississippian Bretsky relied on the work of Craig (1954) and Ferguson (1962) who studied the Visean of Britain. Craig examined approximately 0.6 meters of a calcareous shale from a single locality, and collected and analyzed about 5000 fossils of which 40% were macrofossils. From this Craig identified two PAC's: the *Lingula squamiformis* - *Nuculopsis gibbosa* - *Sanguinolites costellatus* community from an inferred near-shore, rough water environment; and the *Posidonia corrugata* - arenaceous foraminifer - *Waylandella cuneola* (ostracod) community from a slightly

Figure 10. Bretsky's (1969b) chart outlining the evolution of Paleozoic marine benthic communities. Data for Mississippian communities were derived from Craig (1954) and Ferguson (1962).

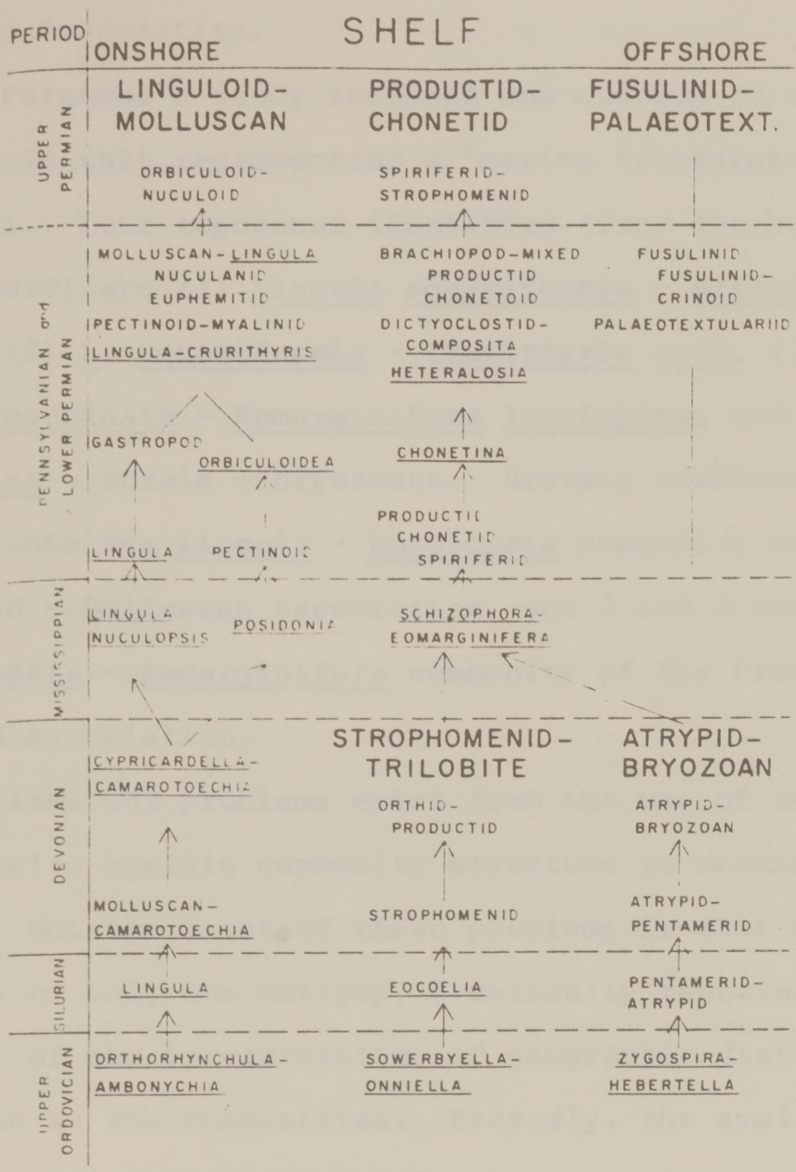

PERIOD
SHELF
ONSHORE
OFFSHORE
UPPER PERMIAN
LINGULOID-MOLLUSCAN
PRODUCTID-CHONETID
FUSULINID-PALAEOTEXT.
ORBICULOID-NUCULOID
SPIRIFERID-STROPHOMENID
PENNSYLVANIAN and LOWER PERMIAN
MOLLUSCAN-LINGULA
NUCULANID
EUPHEMITID
PECTINOID-MYALINID
LINGULA-CRURITHYRIS
BRACHIOPOD-MIXED
PRODUCTID
CHONETOID
DICTYOCLOSTID-
COMPOSITA
HETERALOSIA
FUSULINID
FUSULINID-
CRINOID
PALAEOTEXTULARIID
GASTROPOD
ORBICULOIDEA
CHONETINA
PRODUCTID
CHONETID
SPIRIFERID
LINGULA
PECTINOID
MISSISSIPPIAN
LINGULA
NUCULOPSIS
POSIDONIA
SCHIZOPHORA-
EOMARGINIFERA
DEVONIAN
STROPHOMENID-TRILOBITE
ATRYPID-BRYOZOAN
CYPRICARDELLA-
CAMAROTOECHIA
ORTHID-
PRODUCTID
ATRYPID-
BRYOZOAN
MOLLUSCAN-
CAMAROTOECHIA
STROPHOMENID
ATRYPID-
PENTAMERID
SILURIAN
LINGULA
EOCOELIA
PENTAMERID-
ATRYPID
UPPER ORDOVICIAN
ORTHORHYNCHULA-
AMBONYCHIA
SOWERBYELLA-
ONNIELLA
ZYGOSPIRA-
HEBERTELLA

Figure 10

farther offshore environment. Bretsky has appropriately placed both of these communities in his Linguloid - Molluscan Association.

Ferguson's study included one outcrop of a 2.8 meter-thick shale unit representing a "marine transgression" (p. 1090). Four topozones identified (from the base of the unit upward) are (1) Lingula squamiformis - Streblopteria ornata, (2) L. squamiformis - Crurithyris urei, (3) Schizophoria resupinata - Eomarginifera longispina, and (4) E. longispina - corals - bryozoans. Bretsky combined topozones 1 and 2 into the Lingula - Nuculopsis community of the Linguloid - Molluscan Association, and 3 and 4 into the Schizophoria - Eomarginifera community of the Productid - Chonetid Association.

Inherent problems exist from the use of these studies to summarize benthic community structure in Mississippian strata. Not the least of these problems is that each study was done on only one outcrop, drastically reducing the validity of the interpretation of geographic distribution and variation in the communities. Secondly, the small thickness of rock studied by Craig and Ferguson may represent a time interval too brief, with its physical conditions too transitional, to permit the establishment of stable communities. Craig's study was strictly limited to the "nearshore" communities, but Ferguson's unit grades upward into a limestone with "Lithostrotion reefs" (p. 1106). Nonetheless, there is no community which Bretsky feels should be placed in the "offshore" community associations (fig. 10), leaving a gap between the top of the Atrypid - Bryozoan Association of the Lower and Middle Paleozoic and the Fusulinid - Palaeotextulariid Association of the Upper Paleozoic (Pennsylvanian and Permian). This gap, and the one in Ferguson's work that corresponds to the position of Craig's *Posidonia* community, indicates the problems associated with oversimplifying marine communities and associations of communities in an onshore-offshore transitional sequence.

An attempt has been made by Anderson (1971) to place more emphasis on tectonic factors related to depositional environment. His models include:

> (1) . . . low slope epeiric seas (in the order of one foot per mile) where waves impinge on the substrate and are dissipated some distance offshore producing a low energy subtidal zone onshore. (2) . . . epeiric seas where the zone of maximum wave and current agitation is at or near the shoreline. Such condition is associated with shores which are building out or prograding or with shores of higher slope (in the order of five to ten feet per mild). Progradation tends to fill low-energy onshore zones and steeper slopes do not leave room for them to develop as separate recognizable entities onshore from the zone of wave dissipation. (p. 296).

Anderson correlated the number of recognizable communities with the type of model, there being more communities with the more stable Model 1. In short, Anderson is emphasizing water depth and kinetics related to wave energy as a function of depth. He still maintains the simplified concept of onshore to offshore transitions, and the addition of wave energy and depth as variables are still insufficient to describe community distributions, even in a general overview.

The non-uniform influx of sediment into a marine basin effectively creates barriers between previously existing areas of similar environment and produces areas of variable geographic and temporal span with a wide range of physical environments. Parker's (1956) correlation of macrofauna and sedimentary environments in the Holocene Mississippi River delta area is an excellent example showing that no straight line can be drawn from the "onshore" to "offshore" areas that will include all environments. Thus, the juxtaposition of communities in a "normal" onshore to offshore sequence may be precluded, and any very small area studied may result in the sampling of non-typical assemblages. The "missing communities" in Ferguson's work might be explained in terms of depositional environment and lateral distribution of controlling facies, and may be expected to occur either further offshore or in a lateral position, depending on local conditions of sedimentation.

Benthic Marine Communities in the Floyd Shale

Faunal assemblages observed in the Floyd Shale have been grouped into five communities of benthic organisms. Each community is distinguished from the others by the numerical dominance of a few groups of animals and may show a wide range in faunal diversity. The lowest taxonomic level used to define communities is the genus, thus catagorizing all five Floyd Shale benthic communities as Parallel Communities after Thorson (1957).

The five communities I have identified from the Floyd Shale are named for the dominant groups of organisms and are (1) *Lingula*, (2) molluscan-spiriferid-productid, (3) fenestellid, (4) pelmatozoan-spiriferid-bryozoan, and (5) coral-pelmatozoan. In addition there are 13 fossiliferous localities, which have not been assigned to any community because of the absence of benthic organisms or insufficient abundance or diversity of diagnostic forms.

The distribution of the five communities (fig. 11) suggests that Community 1 may have been more restricted to nearshore environments, and Community 5 may have been restricted to far offshore environments. The distribution of communities appears to be related to associated rock types and depositional environments. The occurrence of different communities in close geographic proximity is in part due to the stratigraphic position of each locality, and changes in communities accompanying changes in the physical environment in a given area.

Discussion of communities stresses the importance of major groups of organisms and the general faunal composition. Also of importance is the interrelationships among organisms and their relation to the substrate and rate of sedimentation.

Figure 11. Distribution of marine benthic communities identified from the Floyd Shale of northwest Georgia.

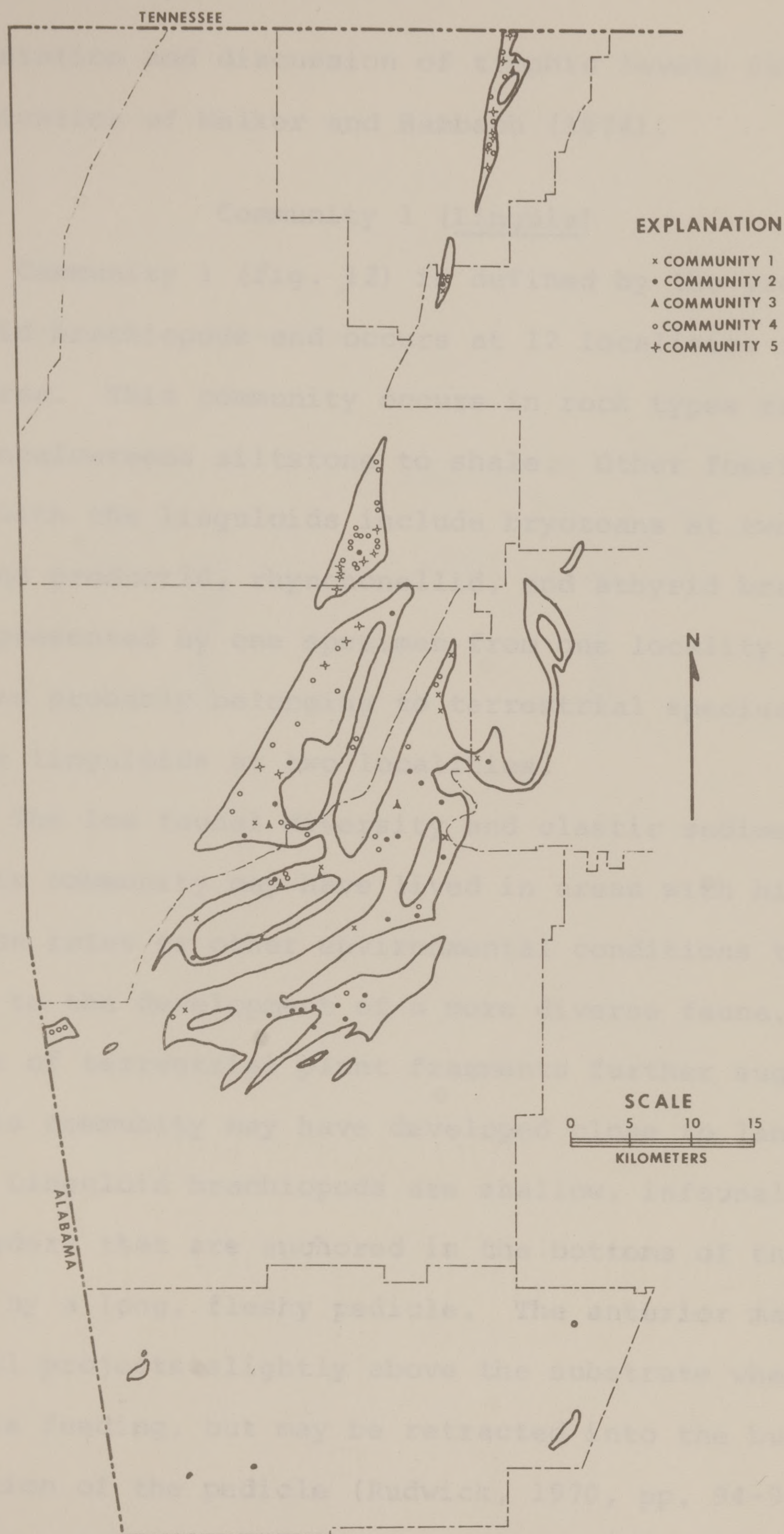

TENNESSEE
EXPLANATION
× COMMUNITY 1
• COMMUNITY 2
▲ COMMUNITY 3
○ COMMUNITY 4
✢ COMMUNITY 5
N
SCALE
0 5 10 15
KILOMETERS
ALABAMA

Figure 11

Interpretation and discussion of trophic levels follows the classification of Walker and Bambach (1974).

Community 1 (Lingula)

Community 1 (fig. 12) is defined by the presence of linguloid brachiopods and occurs at 12 localities in the study area. This community occurs in rock types ranging from noncalcareous siltstone to shale. Other fossils associated with the linguloids include bryozoans at two localities and productid, rhynchonellid, and athyrid brachiopods, each represented by one specimen from one locality. Plant fragments probably belonging to terrestrial species occur with the linguloids at two localities.

The low faunal diversity and clastic sediment suggest that this community may have lived in areas with high sedimentation rates or other environmental conditions that were adverse to the development of a more diverse fauna. The presence of terrestrial plant fragments further suggests that this community may have developed close to land.

Linguloid brachiopods are shallow, infaunal, suspension feeders that are anchored in the bottoms of their burrows by a long, fleshy pedicle. The anterior margin of the shell projects slightly above the substrate when the animal is feeding, but may be retracted into the burrow by contraction of the pedicle (Rudwick, 1970, pp. 94-95). This allows linguloids to survive during periods of moderate

Reconstruction of Community 1

Figure 12

sedimentation by moving upward in their burrows to the new sediment-water interface. Recent _Lingula_ have been reported from such "unstable" environments as estuaries where there may be rapid changes in sedimentation, salinity, or temperature caused by inflowing fresh or brackish water.

Community 1 may have occurred in any environment where physical conditions precluded the growth of other organisms. Prodelta environments were probably a suitable place in the Floyd Shale for the development of this community, because the constant "rain" of sediment and detritus, while producing difficult conditions for most epifaunal or shallow infaunal organisms, probably provided a constant source of food for the protected linguloids. Furthermore, they could escape burial simply by burrowing upward in the newly deposited sediment. Orientation of most _Lingula_ shells parallel to bedding suggests that currents or perhaps small turbidity flows from the delta front may have uprooted some linguloids. At localities where _Lingula_ is abundant, specimens fall within a wide range (1 to 2 cm.) of sizes.

Community 2 (Molluscan-Spiriferid-Productid)

Faunas in Community 2 may be recognized by the variety of bivalves and gastropods, and the conspicuous presence of large brachiopods such as _Inflatia inflata_ and _Spirifer arkansanus_ (fig. 13). This community is further characterized by having few bryozoans and echinoderms.

Reconstruction of Community 2

Figure 13

Community 2 occurs within rocks that range from shale to argillaceous limestone.

Diversity of organisms is commonly very high in this community and normally includes the basic faunal elements mentioned above. A typical example would include abundant "low-level" suspension feeders, particularly spiriferid and athyrid brachiopods, and browsing or epifaunal deposit feeding gastropods. Also, abundant "quasi-infaunal" productid brachiopods and planated and resupinate strophomenid brachiopods probably maintained a very low profile of suspension feeding on the bottom. Shallow burrowing bivalves, such as the nuculids, reworked sediments near the surface by deposit feeding. A few "high-rise" suspension feeders like fenestellid bryozoans and crinoids were also present.

Echinoderms are commonly regarded as indicating "normal marine conditions," especially salinity. Where this community includes echinoderms, it was probably well removed from any influx of fresh water. Water circulation must have been sufficient to maintain a suspension of nutrients needed to feed the several "layers" of suspension feeders, while still leaving nutrients for browsers and deposit feeders. Algae or other plants growing on the bottom probably contributed to the food chain. Sedimentation was probably slow, otherwise the large numbers of sessile organisms could not have lived in this environment.

The presence of terrestrial plant fragments associated with Community 2 suggests that this assemblage of animals may have thrived close to the shore. Two likely environments in which this community may have lived are mud shelf and muddy embayment. The great thickness of carbonate rocks to the northwest suggests that Floyd deltas prograded over a shallow carbonate shelf. Community 2 may have become established on the distal parts of the prodelta or on relict prodelta muds left from abandoned delta lobes. The distribution of Community 2 localities suggests that this community was developed toward the south and east, closer to the sides of active sedimentation. I believe, therefore, that this community developed in muddy embayments adjacent to principal delta lobes. Within an embayment, elements of the fauna were probably distributed with respect to any fresh water influence, perhaps explaining the limited distribution of echinoderm remains.

Shells in this community are rarely abraded. Echinoderms display varying degrees of disarticulation. Nuculoid bivalves are commonly articulated. No size sorting is apparent at most localities, suggesting little reworking of the fauna.

Community 3 (Fenestellid)

Community 3 consists dominantly of fenestellid bryozoans, almost to the exclusion of other organisms (fig. 14). Faunas commonly include large numbers of fenestellid fronds, Archimedes, a few echinoderm stem fragments, and brachiopods such as Composita, Reticulariina, and productids. Community 3 occurs in rocks ranging from slightly calcareous siltstone to shale.

Diversity of major types of organisms appears to be low in Community 3, but closer examination and identification of fenestellid fronds might indicate high diversity among bryozoans at the species level. The community was dominated by "high-rise" suspension feeding fenestellid bryozoans and possibly a few echinoderms. Locally, the sea floor may have been so densely populated by bryozoan colonies that little food was deposited on the substrate for other trophic levels to utilize. Where there was living space, athyrid, spiriferid, and productid brachiopods occupied the niche of lower level suspension feeders.

Fenestellid bryozoan colonies are well adapted for efficient feeding in areas with constant prevailing currents. The presence of zooecia on only one side of the front suggests this adaptation (Cowen & Rider, 1972, p. 156). Currents must have been able to bring an abundance of food to areas in which Community 3 thrived. Where bryozoans literally covered the bottom, they were probably able to entrap a large amount of available food, depriving the low-lying brachipods. The requirement that bryozoans cement themselves to a firm substrate (including shells or other bryozoans)

Reconstruction of Community 3

Figure 14

(Duncan, 1957, p. 784) may have made the bottom unsuitable for browsers or most types of deposit feeders.

Sedimentation would have had to occur at a low rate to prevent oversiltation of the bryozoan colonies. Like Community 2, Community 3 may have been well removed from fresh-water inlets in embayments, but may have developed in or just beyond the very distal parts of prodelta facies.

Most echinoderm fragments in Community 3 are stems that are disarticulated or abraded suggesting that they may have been subjected to postmortem transport. However, many of the bryozoan colonies are large sections of fronds that do not appear to have been reworked by wave or current action. At some localities, axes of Archimedes are preserved with parts of the fenestellid fronds attached. Most fronds are sufficiently well preserved as molds in shale and siltstone to show individual zooecia.

Community 4 (Pelmatozoan-Spiriferid-Bryozoan)

Dominant organisms in Community 4 include blastoids and crinoids accompanied by a variety of spiriferid (including athyrid) brachiopods and relatively abundant bryozoans, especially fenestellids (fig. 15). Other faunal groups commonly represented by smaller numbers include productid and terebratulid brachiopods and small rugose or tabulate corals. This community occurs within lithic types ranging from very calcareous shale to fine-grained limestone that are commonly

Reconstruction of Community 4

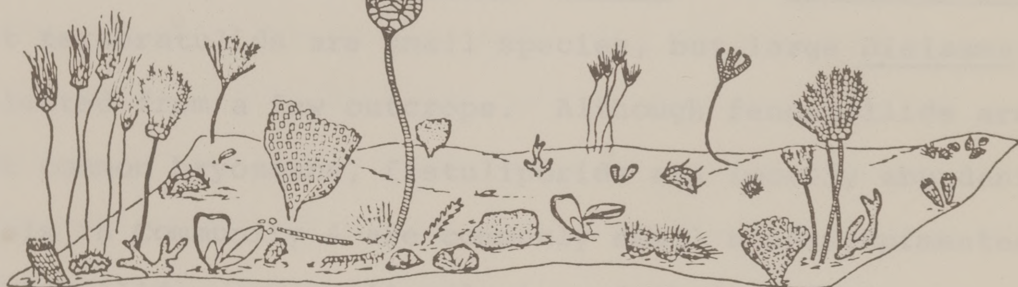


Figure 15

deeply weathered, leaving a red to brown clay saprolite containing silicified fossils.

The faunal diversity is commonly higher in Community 4 than in other communities of the Floyd Shale. Many localities have yielded large numbers of crinoids, inadunates being the most common. Spiriferid brachiopods are commonly small species and include punctate and athyrid forms. The most common productids are Inflatia, Ovatia, and Echinoconchus. Most terebratulids are small species, but large Dielasma were collected from a few outcrops. Although fenestellids are the most common bryozoans, fistuliporids are locally abundant. Corals in Community 4 are commonly small nondissepimented hapsiphyllids, and small colonies of the tabulate Michelinia are present at a few localities. Mollusks are not common in Community 4, but a few gastropods and bivalves were collected at some localities.

Community 4 was probably conspicuous by the large numbers of stemmed echinoderms. Large flexible and inadunate crinoids were the tallest of the "high-rise" suspension feeders. The lower story of "high-rise" suspension feeders included large numbers of pentremitid blastoids, small inadunate crinoids, and fenestellid bryozoans. Small camerate crinoids were also present. Below them were the "low-level" suspension feeders, dominated by spiriferid and athyrid brachiopods and perhaps locally by small patches of rugose corals. Also present at this level were the terebratulid brachiopods, and slightly lower may have been the "quasi-infaunal" productids. Browsing or deposit feeding gastropods lived on the bottom, whereas commensal platycerids were probably attached to the anal vents of the larger crinoids.

Conditions appear to have been favorable for most groups of organisms to live in Community 4 except for the infaunal groups. Because many of the "high-rise" feeders required a firm substrate for settlement of larvae, the bottom may not have been suitable for shallow burrowing due to the accumulation of shell debris or lithification. Currents and available food must have been sufficient to allow nutrient distribution to all levels, especially the low-lying suspension feeders.

The high carbonate content (observed and inferred) in the rocks of Community 4 suggests that this community may have lived on a shallow carbonate shelf, and may locally have become developed on flanking beds of carbonate banks. The rate of sedimentation must have been relatively low to prevent siltation, although the occurrence of articulated echinoderms at some localities suggests that they may have been overwhelmed by a heavy sediment load. Many other localities have yielded disarticulated echinoderm calyx plates, but stems may occur in long segments indicating rapid burial or little current activity.

Community 5 (Coral-Pelmatozoan)

Assemblages in Community 5 are dominated by rugose and tabulate corals and pelmatozoan echinoderms (fig. 16). Articulate brachiopods may be locally diverse and abundant and most faunas include bryozoans, particularly the fenestellids. As in Community 4, most localities containing Community 5 occur as red to brown clay saprolites with silicified fossils. At localities where this community has been identified in unweathered rock, it occurs within coarsely crystalline, skeletal limestone.

Faunal diversity is lower in Community 5 than in 4. The most diverse groups are the corals and echinoderms. Rugose corals include colonial and solitary dissepimented and nondissepimented forms. The tabulates are not very diverse, and the most common genus is *Michelinia*, as in Community 4. Echinoderm remains include blastoids and crinoids, with the latter commonly disarticulated. Most brachiopods are the same as those in Community 4.

Community 5 included "high-rise" suspension feeding echinoderms and bryozoans with a few large flexible crinoids towering above the others. Below these were patches of lithostrotionid corals and small areas with abundant hapsiphyllid and tabulate corals and fistuliporid bryozoans. Still lower among the suspension feeders were the articulate brachiopods. There were probably a few browsing or deposit feeding gastropods on the sea floor, and again the

Reconstruction of Community 5

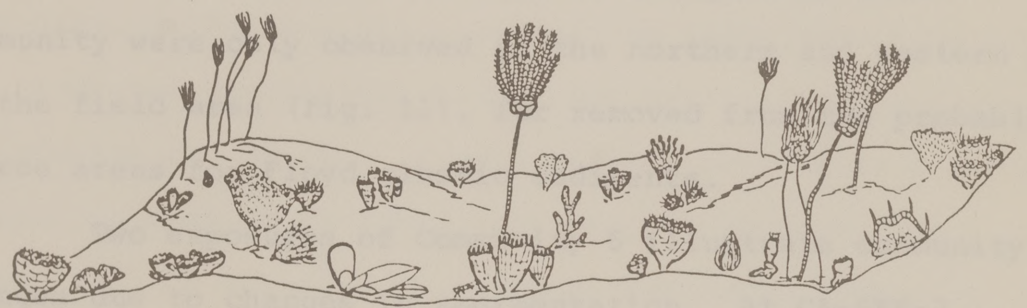


Figure 16

platycerids probably lived commensally on large crinoids. The apparent absence of burrowing organisms may have been due to the abundance of skeletal debris in the substrate.

Community 5 probably required sufficient circulation to maintain a nutrient supply and may have been well adapted to an environment that was strongly affected by wave and current action. Certainly the community appears to represent an offshore environment; localities assigned to this community were only observed in the northern and western parts of the field area (fig. 11), far removed from the probable source areas for Floyd clastic sediments.

Two exposures of Community 5 illustrate community changes due to changes in sedimentation. At CA-6EE-2, Community 5 is developed in coarse, bioclastic limestone containing abundant echinoderms and small patches of Lithostrotion proliferum Hall. At the top of this limestone unit is a relatively sharp lithic break, above which the rock is a calcareous shale and siltstone. The lower part of the clastic unit contains abundant fragments of the terrestrial lycophyte Archaeosigillaria. Above the plant-bearing beds, the calcareous shale contains a marine fauna dominated by productid and spiriferid brachiopods, echinoderms, bryozoans, and hapsiphyllid corals; this assemblage is typical of Community 4. This sequence is interpreted as an interruption in the development of the carbonate bank at CA-6EE-2, during which a pulse of sediment, perhaps related to a terrestrial flood event, smothered the existing environment with fine-grained clastic sediment. As the sedimentation decreased, the environment became favorable for a diverse fauna that was better adapted to a muddy bottom.

Another example of a change in communities is locality CH-3E-3, where a medium to coarsely crystalline limestone containing abundant blastoids, hapsiphyllid corals, and a few brachiopods grades abruptly upward into dark gray, calcareous shale containing large strophomenid and productid brachiopods with a few spiriferids; corals and echinoderms are absent. I believe this represents a change similar to that at CA-6EE-2, but here it appears that Community 5 is replaced by a fauna similar to Community 2. These examples, however, provide the only evidence of community replacement that I observed in the Floyd Shale, but it is likely that under the proper circumstances any community could replace another.

Similar phenomena related to community replacement have been described by Ziegler (1965) for faunas in the clastic Silurian rocks of Wales. In his study, Ziegler interpreted changes in depth as an important factor in controlling the replacement of one community by another. The replacement of nearshore communities by more offshore communities by more offshore communities was less abrupt than the reverse.

PALEOECOLOGY OF MAJOR TAXA

The following discussion of important groups of fossils from the Floyd Shale interprets the relationships among many of the common genera and species and their paleoecologic requirements. A survey of literature on the paleobiology and paleoecology of major groups has been used to evaluate specific taxa in the Floyd Shale and to identify and understand the communities present. This section deals in more detail with the specific adaptations and requirements of taxa within the different phyla present and attempts to provide reasons for their distribution among the communities and in different lithic types.

Bivalves

Bivalve mollusks are uncommon in the Floyd Shale, but the nuculoids (especially Phestia) and the pectinids (e.g. Aviculopecten) are locally abundant. Stanley (1970) discussed shell form in recent bivalves and suggested that the nuculoids are well adapted for shallow burrowing and deposit feeding in a soft, fine-grained substrate. Adaptations to this way of life include small size, thin shell, and large foot. Nuculoids were collected at eight localities in the Floyd Shale of which seven are assigned to Community 2 and the other to Community 4.

Pectinid and pterioid bivalves occur at seven localities in Community 2 and three in Community 4. Other bivalve genera include Schizodus, Edmondia, Cypricardella, and Permophorus, collected at only a few localities, mostly from Community 4. Stanley implied that Paleozoic bivalves may not have been excluded from offshore niches by competition with articulate brachiopods. Although this may have been a factor with epifaunal bivalves, the post-Paleozoic radiation of bivalves included large numbers of shallow infaunal forms that would not have had to compete with brachiopods. Bivalve distribution in the Floyd Shale indicates that, although infaunal deposit-feeding nuculids may have been restricted to protected embayments, other groups enjoyed a wider distribution.

Brachiopods

Cooper (1937) discussed major trends in brachiopod adaptation directed toward improving or maintaining

> . . . the animal's ability to bring currents of water into the shell. This is the most important function of a brachiopod because the currents bring life-maintaining food and oxygen. (p. 38).

It is important that the anterior and lateral margins of the shell be above the substrate, because these areas are the inlets and outlets for water.

Adaptations described by Cooper and found in the Floyd Shale include folding (e.g. Spirifer, Composita, most rhynchonellids), whereby a moderate to strong fold in the brachial valve, which rested on the substrate, kept the lateral margins of the valves raised above the bottom. Alation and mucronation (e.g. Spirifer, Punctospirifer) may be specially adapted to a soft substrate, as Cooper suggested for the extreme mucronation of the Devonian Mucrospirifer mucronatus. He stated that,

> . . . these brachiopods were not attached closely to a hard substratum. Not only the symmetry of the shell but the strongly incurved beak would make close attachment to a hard substratum difficult. (op cit, p. 42)

Compressed forms (e.g. Chonetes, Orthotetes) ". . . have a maximum of oxygen-gathering tissue exposed to the water . . ." because "water immediately in contact with a mud surface is normally very poor in oxygen." (ibid.) Other flat forms like Schuchertella avoid the problem of oxygenation by resupination; that is,

> . . . the young shell possesses a convex ventral valve and a flat or concave dorsal valve, but in maturity the condition is reversed, the anterior of the ventral valve becoming more or less deeply concave and the dorsal value becoming strongly convex. (op cit, p. 43)

Finally, Cooper stressed the importance of spines (e.g. Chonetes, most productids) as both anchoring and supporting devices, which successfully maintain the anterior margin of the brachiopod above the substrate.

Rudwick (1970, p. 91) suggested that chonetid brachiopods may be further adapted to swimming in a manner similar to pectinid bivalves, but in a posterior direction.

This would certainly adapt these forms to live in areas where rates of sedimentation might be so high at times as to preclude survival of other types of brachiopods. Rudwick also suggested an anchoring and supporting function for productid spines, and indicated that some productids may have closely approached an infaunal life style (p. 93). Even if sediment accumulated on the dorsal (brachial) valve, the valve trails could be extended by acretion and maintained above the sediment.

Brachiopods are one of the most common and diverse groups of organisms in the Floyd Shale, but the inarticulates are uncommon. Lingula was collected from 12 localities, but was not observed in its vertical "growth" position. Community 1 is defined by the presence of Lingula; other fossils in this community are rare and commonly fragmented. Other inarticulates (e.g. Orbiculoidea, Oehlertella, Crania) are less common, with Crania commonly attached by cementation of its pedicle vavle to the pedicle valves of productid brachiopods, and the others are unattached in shale. The modes of attachment of Crania to the ventral valves of productids is difficult to interpret, especially if the productids were living in a semi-infaunal style as suggested by Rudwick. One possibility is that the inarticulates survived so long as they were not buried in sediment, and were killed if the productids sank into the mud or were buried in newly deposited sediment. Another possibility is that the craniids became attached to "uprooted" or other shells that had been disturbed from their original growth position. In the Floyd Shale, Crania showed a preference for Community 4 (3 of 4 occurrences), but Orbiculoidea and Oehlertella were only observed in Community 2.

Among the articulate brachiopods, the orthids are represented by Perditocardinia, Rhipidomella, and ?Schizophoria, and were collected at 15 localities, which are all assigned to Communities 4 and 5. The very small pedicle opening in these genera may be related to an adaptation to a low energy environment or sheltered areas.

Strophomenid brachiopods are locally common in Communities 2, 4, and 5. The most common genera are Chonetes, Schuchertella, and Orthotetes, none of which had a large or well developed pedicle in the adult stages. They include both compressed and resupinate forms adapted to maintaining a low profile or conforming to the contour of the sea bottom. Although their large, flat shells may have provided support on a muddy bottom, they were probably unable to survive burial by sedimentation, except Chonetes, which as previously mentioned, may have been able to swim.

The productids are among the most diverse and abundant groups of brachiopods in the Floyd Shale, and range in size from large Echinoconchus to very small Protoniella. The most common genera are Inflatia, Echinoconchus, and Ovatia, which are all medium to large forms; the only notable exception is the small species Echinoconchus biseriatus (Hall) that is abundant at a few localities. Although most productids occur in Communities 4 and 5, some large species (especially Inflatia inflata) are abundant in Community 2. One specimen of Ovatia was collected at G-2EE-1, which contains Lingula and is assigned to Community 1. Because it was not collected directly from the shale, but rather from a small gully at the base of the outcrop, Ovatia may not have lived in the same environment as Lingula.

Rhynchonellids are uncommon in the Floyd Shale, and include a few specimens of Leiorhynchoidea and Pugnoides. They were collected from 12 localities in Community 2, and are considered more characteristic of that environment, and are rare in Communities 4 and 5 (3 localities).

Spiriferid brachiopods are nearly as abundant and diverse as the productids. They are common in Communities 2, 4, and 5, and may be locally common in Community 3. Large forms include Spirifer, Torynifer, and Brachythyris; small forms include small species of Spirifer, and Crurithyris. Punctate spiriferids include numerous specimens of Reticulariina, Eumetria, and Punctospirifer, which occur in Communities 2 through 5. Athyrid spiriferids include the common genera Composita and Cleiothyridina. Composita was collected from all communities, but is most abundant in 2 and 4 and most rare in 1. Cleiothyridina, however, appears to have a much smaller distribution. In 43 of 44 occurrences, this genus was associated with corals, and are assigned to Communities 4 and 5. The other occurrence, F-1E-12, is associated with terrestrial plant remains, bivalves, spiriferid and productid brachiopods, but with rare bryozoans and echinoderms; corals are absent. This locality is assigned to Community 2.

Rhynchonellids, spiriferids, and terebratulids are all characterized by large pedicle openings. In most spiriferids the opening is triangular, whereas in the athyrid and retziid spiriferids and in the rhynchonellids and terebratulids it is oval. Similar adaptations to living conditions as indicated by shell morphology are not suggested by the shape and size of pedicle openings. Forms with the triangular foramen are widely distributed among the communities, except for Community 1. Of the forms with circular to oval pedicle openings, the most widespread taxa are those with strong folding of the valves or costate or plicate shells. Neither the terebratulids nor <u>Cleiothyridina</u> have deeply folded shells, costae or plications. The development of folds, anterior spines, costae, and other anterior ornaments may be adaptations to sort particles that enter the interior of the brachiopod shell (Rudwick, 1970, pp. 111, 116). The absence or slight development of these anterior devices may indicate adaptations to environments relatively free of large amounts of moving sediment. The terebratulids certainly have the least anterior ornamentation, but they may have taken in quantities of sedimentary particles (e.g. clay and silt) as do recent terebratulids (Suchanek & Levinton, 1974). *Cleiothyridina*, however, possesses numerous overlapping spine lamellae that are directed anteriorly and which might have effectively strained out unwanted particles.

Rudwick (1970, p. 82) suggested that brachiopods with a transapical foramen (migration of pedicle opening through the apex of the pedicle valve through ontogeny) may be specially adapted to living in calcareous substrates. The process of moving the pedicle opening implies, in part, the ability of the brachiopod to dissolve and re-deposit the calcareous material of the shell. Rudwick stated that,

> . . . it is probably significant that the living brachiopods (e.g. *Terebratulina*, *Chlidonophora*) with pedicle rootlets able to resorb calcareous material in the substrate are also among those with transapical foramina. (p. 82)

Furthermore, he has found that only three groups of brachiopods have been known to have transapical foramina: terebratulids and the two atrypid groups, Retziacea (e.g. *Eumetria*) and Athyridacea (e.g. *Composita*, *Cleiothyridina*). This resorption mechanism is another possible reason why the terebratulids and *Cleiothyridina* appear to be limited to very calcareous rocks in the Floyd Shale.

Bryozoans

Ectoproct bryozoans are very common in Floyd Shale faunas; the most common bryozoan classes being the Cyclostomata and the Cryptostomata. Cyclostomes are represented primarily by ramose and bifoliate forms assigned to the Fistuliporidae. Of these, the ramose forms are more common in Communities 4 and 5 than in 2 and 3.

The most abundant forms are "*Fenestella*," "*Lyropora*," and *Archimedes* of the family Fenestellidae (Cryptostomata). Condra and Elias (1944) thoroughly discussed the taxonomy of *Archimedes* and suggested that the genus actually represents a symbiotic relationship between a fenestellid bryozoan and a calcareous alga. They regarded the massive axis to be the alga, and believe that it helped provide for better current circulation in and around the bryozoan colony. They further suggested that the massive supports in *Lyropora* and *Lyroporella* may also have been algal symbionts. However, Tavener-Smith (1969) showed that the massive supports of *Lyropora* and *Archimedes* are actually secondary deposits formed by secretions of the external mantle tissue of the bryozoan colony.

Duncan (1957, p. 784) reported that, "shifting sands and muddy bottoms without an admixture of larger debris are not suitable for the fixation of most [bryozoan] larvae. . . ." She suggested that environments most favorable for bryozoans are the fore-reef, talus slopes, flank beds, and spreading fringes. There the colonies may have trapped particulate material and contributed large amounts of skeletal debris. Community 3 is characterized by the dominance of fenestellid bryozoans, but the characteristic rock type is shale to calcareous shale and may have not provided a very firm bottom. Community 3 fenestellids may have attached to debris such as brachiopod shells for support. Communities 4 and 5 probably include most of the favorable environments described by Duncan, and bryozoan fragments are very common in most limestones in the Floyd. "Lyropora" was only observed in Communities 4 and 5 (20 localities) and may have been adapted to those conditions with its massive support and small fan of zooecia. Archimedes and fenestellid fronds were collected from rocks ranging from coarsely crystalline limestone to siltstone, and may have had a broad tolerance to physical conditions.

Cephalopods

Among the most striking elements of many faunas in the Floyd Shale are the cephalopods, but I have not used them in constructing communities for several reasons. Although some cephalopods (especially orthoconic nautiloids) may have rested or crawled along the bottom, many forms probably were highly motile and swam or floated. Thus, they may not be characteristic of any particular sedimentary environment. After death, many forms may have floated then sank to the bottom (Reyment, 1958). The shell forms suggested by Reyment to be the most susceptible to rapid sinking include strongly compressed, depressed, and evolute types. He further suggested (1958, 1970) that many sunken shells of ammonoids may come to rest on their venters. This phenomenon occurs in nearly all Floyd Shale specimens of Cravenoceras and in the specimens of Lyrogoniatites from F-2E-3, which are all crushed perpendicular to the plane of bilateral symmetry.

The common ammonoid genera in the Floyd Shale are the slightly evolute depressed forms (i.e. Cravenoceras, Lyrogoniatites) and involute compressed forms (i.e. Neoglyphioceras), all highly sinkable types according to Reyment (1958). However, at some localities, I believe there is evidence for post-mortem accumulations of ammonoid shells for concentrations of Lyrogoniatites newsomi georgiensis Miller and Furnish, in siderite nodules occurring in otherwise barren shale. Inside the nodules are commonly several well preserved molds of the ammonoid, with petrified plant remains or brachiopod molds. The ammonoids do not appear to be size sorted, and the plants (e.g. Lepidodendron) commonly show preservation of delicate structures like leaves and conducting cells. I believe that these assemblages represent the preservation of post-mortem accumulations of organisms (perhaps excepting the brachiopods) by a process like that proposed by Zangerl (1971) for similarly preserved material in the Fayetteveille Shale of Arkansas. The ammonoids may have become concentrated by water movement in places where terrestrial plants were being introduced into the marine basin by flooding events. The nodules nucleated about the decaying organic matter in an environment with sufficient available iron.

Other ammonoid genera are neither preserved in the same manner nor present in such large numbers as *Lyrogoniatites*. They are not common enough at any locality to be used in defining communities.

Similarly, nautiloid genera are neither sufficiently abundant nor widespread to be used in community definitions. Nonetheless, they may be useful in other community studies. The coiled nautiloids (e.g. *Stroboceras* and *Tylonautilus*) may have been susceptible to rapid sinking. *Stroboceras* is highly compressed, and *Tylonautilus* is only very slightly involute.

Corals

Wells (1957, p. 774) summarized interpretations of Paleozoic coral paleoecology, stating that:

> . . . most Paleozoic corals lived in ecologic niches similar to those occupied by non-surface, essentially lagoon, reef corals of the present day: 1) to a maximum depth of about 50 meters, 2) well within the lighted zone, although there is no evidence that illumination was significant in their growth or well being, 3) in temperatures with annual minima between 16° and 21°C., 4) in well-oxygenated, gently circulating water, and 5) on bottoms clear or relatively free from rapid accumulation of sediment, but not necessarily in clear, nonturbid water.

Both rugose and tabulate corals are locally abundant in the Floyd Shale, and their presence is used here to define the limits of Communities 4 and 5.

In the 69 localities assigned to Communities 4 and 5, 67 contain rugose corals, of which the most important group are the hapsiphyllids and the "lithostrotionids."

Hapsiphyllids are small to medium sized, solitary corallites with a well developed fossula and no dissepiments, and include *Amplexizaphrentis* and *Zaphrentoides*. "Lithostrotionids" include small to large colonial forms that have dissepiments and a weak or absent fossula. The remaining dissepimented corals from the Floyd Shale probably belong in *Koninckophyllum*.

Duncan (1962, p. 65) discussed the distribution of dissepimented and nondissepimented corals from the Pennsylvanian, and suggested that the distribution of the two forms was controlled by sedimentary environment. Jeffords (1948, p. 44) similarly concluded that in the Pennsylvanian of Kansas dissepimented corals occurred in more calcareous rocks, whereas nondissepimented forms (lophophyllidids in both studies) were present in rocks ranging from shale to limestone.

Correlation of corals with lithic composition cannot be made precisely in the Floyd Shale, because most of the original rock types have been obscured by weathering. Nonetheless, all corals associated with the unweathered rock were collected from limestone.

Many rugose corals may have developed secondary means of support in order to adapt to a high energy environment or strong asymmetry in the corallite. The most obvious example is the growth of epithecal talons in *Cystelasma*, although the slender spines of *Amplexizaphrentis spinulosus* may also have contributed to its support if they reached the bottom. A few examples of Koninckophyllum are twisted and contorted, indicating a negative geotropic response to being knocked down and rolled on the substrate.

Tabulate corals are not so abundant as the Rugosa, and the only common forms in the Floyd Shale are Michelinia (25 localities) and Palaeacis (5 localities). Tabulates were collected at 32 localities from very deeply weathered rocks, but the original rocks were probably calcareous. Jeffords (1948, p. 44) observed the genera Syringopora in "shallow-water calcareous shales and thin limestones," and Cladochonus, Michelinia, and Striatopora in shale. These genera, except Michelinia, were collected from only a few localities in the Floyd Shale; no lithic association can be made other than their preference for very calcareous rocks.

The association of corals with a wide range of rock types in the Pennsylvanian rocks of Kansas (Jeffords, 1948; Duncan, 1962) might cast doubt on the advisability of using corals to define communities. In the Floyd Shale, however, no corals were observed in any highly argillaceous or arenaceous rocks or in possible weathering products of these lithic types. I believe they are useful as general paleo-ecologic indicators in the Floyd.

Gastropods

Gastropods are diverse, but not widespread in the Floyd Shale. The most widely distributed forms are the platycerids (e.g. Platyceras, Orthonychia), which have been widely reported as coprophagous forms commensal on the anal tubes of crinoids (Bowsher, 1955). No specimens from the Floyd were found attached in this manner, but all occurred with large numbers of echinoderms in Communities 4 and 5.

Wermund (1969, p. 13) reported the common association of certain gastropod genera with rock types in the Pennsylvanian of north-central Texas. In particular, he observed Bellerophon in limestone, Glabrocingulum in marl, and Trepospira in shale. Each of these genera is also present in the Floyd Shale, and shows similar occurrences to those in Texas. Bellerophon occurs in Communities 4 and 5, as does another locally common genus, Euconospira. Glabrocingulum and Trepospira both occur in Community 2. Other gastropod genera in the Floyd are too rare to suggest any trend in relationship to particular communities.

Echinoderms

Echinoderm larvae require a relatively firm substrate for attachment and growth (Clark, 1915). The presence of echinoderm fragments, however, does not necessarily indicate a proper environment for growth. Porosity of echinoderm fragments has been demonstrated for fossil crinoids (Strimple, 1972), and it is likely that high porosity made plates and other ossicles highly susceptible to easy transport. Dead echinoderms that have been transported long distances would be completely disarticulated, and the plates would probably be abraded.

Echinoderm remains in the Floyd Shale include parts of numerous crinoids, blastoids, and echinoids. All of these forms tend to become disarticulated; this tendency is much less for the blastoids than for the crinoids and echinoids.

Blastoids collected from the Floyd Shale include several hundred specimens of the spiraculate, Pentremites, and parts of four specimens of the rare fissiculate, Hadroblastus. Most Pentremites are articulated, but are commonly laterally compressed. Brachioles, the small feeding appendages of blastoids, are rarely found preserved on the calices, although several such well preserved specimens of Pentremites were collected at F-2E-1. Pentremites were observed only in faunas of Communities 4 and 5, but are locally abundant in Community 4. All specimens of Hadroblastus show evidence of compression. Three specimens collected from F-2E-3 are in Community 2, and one specimen from CH-3E-30 is in Community 5. Fissiculate blastoids had numerous respiratory openings exposed alongside the ambulacra, whereas slitlike spiraculates had tiny pores at the ambulacral margins. The fissiculate slits may have been better adapted to keep out sediment and enabled forms like Hadroblastus to survive in more muddy environments.

Crinoid calices are locally common in the Floyd Shale, and the most common forms are dicyclic inadunates.

Most calices became easily disarticulated after the death of the crinoid. The small appendages (e.g. pinnules, arms, and stem) normally were lost first; then the calyx began to disarticulate. Well preserved crowns and calices are abundant at a few localities (F-2E-1, F-2E-2). At both of these localities, as well as others, the most common articulated crowns and cups belong to the inadunate genera *Phanocrinus* and *Zeacrinites*. One of the most common inadunates at other localities is *Agassizocrinus*. The characteristic remains of this genus are the fused infrabasal plates. Most *Agassizocrinus* probably lost the stem in the adult stage and lived free on the bottom, perhaps enjoying a vagrant life habit.

Large flexible crinoids are represented only by disarticulated calyx plates and a few fused infrabasal circlets. Stems of flexibles may be quite large with a distal stem of wide, unornamented columnals and a proximal stem of thin columnals. Of the major groups of crinoids, the flexibles have the least tightly sutured calices, and are most susceptible to disarticulation after death. Small camerate crinoids, represented by the genera *Dichocrinus* and *Talarocrinus*, are present but not common in the Floyd Shale.

The presence of articulated crinoid calices and crowns at some localities suggests that these specimens were subjected to little or no post-mortem transport. This type of preservation may have been produced by rapid burial or by the individuals falling to the bottom in areas that were protected from current activity. Most crinoid calices and crowns were collected from Communities 4 and 5, although the inadunates Phanocrinus and Agassizocrinus also occur in Community 2 (F-2E-3).

Although echinoid remains are not common in the Floyd Shale, plates and spines of Archaeocidaris were collected from 10 localities. All specimens of this genus occur in Communities 4 and 5.

Plants

All plants collected from the Floyd Shale during this study are terrestrial forms, fragments of what were probably large arborescent plants that were brought into the marine basin by floods. During the time of Floyd deposition, subaerially exposed parts of the deltas (i.e. the delta plain) probably were covered with a forest of arborescent lycophytes (e.g. Lepidodendron, Lepidophloios, and Archaeosigillaria) and sphenophytes (e.g. Archaeocalamites). Other plants that may have been present have not been observed in the marine shale of the Floyd.

At CA-6EE-2, blocks of argillaceous limestone commonly fragments of Archaeosigillaria, but no marine invertebrates. Below the plant horizon, Community 5 is well developed in the coarsely crystalline, bioclastic limestone of a carbonate bank, and above it Community 4 is developed in a calcareous shale. I believe that an upland flood event carried the plants and clay and silt into an area on the carbonate bank where there had previously been very little clastic deposition.

SYSTEMATIC PALEONTOLOGY

Fossils from the Floyd Shale belong in six invertebrate phyla and two plant divisions. The taxonomic order in which the invertebrates are listed follows that of the Treatise on Invertebrate Paleontology (Moore, ed.) and Moore and Strimple (1973). Taxonomy of plants follows the order listed in the Trait'de Paléobotanique (Boureau, ed., 1964, 1967).

The identification of invertebrates is based on comparisons of Floyd Shale specimens with published illustrations and descriptions. For the derivation of paleoecologic information I felt that the identification of all specimens to the species level was beyond the scope of this project, and thus only the more easily identifiable specimens were traced to the specific level. Where possible, specimens were identified at least to the generic level.

Many species and genera can probably be better compared with reports in the more recent literature than with original descriptions, which commonly lack illustrations. Nonetheless, I have attempted to include original bibliographic references to genera and species described herein. Many of these sources were not examined for this study, and only those marked with an asterisk were searched. Several bibliographic and general studies have yielded important information regarding original references and descriptions. Among these are: Coelenterata: Bassler (1950), Cotten (1974); Brachiopoda: Weller (1914), Muir-Wood and Cooper (1960), Carter and Carter (1970); Gastropoda: Knight (1941); Bivalvia: McAlester (1968); Cephalopoda: Gordon (1964); and Echinoderms: Bassler and Moody (1943), Moore and Jeffords (1968). A very important, early work dealing with nearly all invertebrate groups is that of Weller (1898).

Descriptions of taxa included here are brief and designed to compliment illustrations in plates 2 through 16. Distribution data are arranged according to community and locality. Figured specimens are reposited in the collections of The University of Texas at Austin and The University of Iowa, Iowa City, and bear catalog numbers of those institutions (TX and SUI) respectively. Supporting collections are stored at The University of Texas at Austin; The Georgia Geological Survey; Emory University, Atlanta, Georgia; Shorter College, Rome, Georgia; and The University of Iowa, Iowa City.

Kingdom Animalia

Phylum Coelenterata

Class Scyphozoa

Order Conulariida

Family Conulariidae

Genus Paraconularia Sinclair, 1940

Paraconularia species

Plate 2, figure 24

Description: Conulariids with transverse ribs alternating at corner furrows and bent adaperturally. Midline on faces faint.

Distribution: Community 2: F-1E-26, F-1W-53, F-2E-3; Community 4: F-2E-1

Class Anthozoa

Order Rugosa

Suborder Streptelasmatina

Superfamily Cyathaxoniicae

Family Metriophyllidae

* Genus Rotiphyllum Hudson, 1942, p. 257

Rotiphyllum species

Plate 2, figures 4, 10

Description: Solitary, ceratoid corals with all septa joining at center to form dense, axial structure.

Distribution: Community 4: CH-2W-2, WA-3E-15; Community 5: WA-3E-16

Family Polycoeliidae

Genus _Cystelasma_ Miller, 1891, p. 13

Cystelasma species

Plates 2, figures 5, 6, 11

Description: Small, commonly contorted, solitary corals with five septa not joined at the axis, no axial structure. Thick epitheca, commonly with talons.

Distribution: Community 4: F-1W-35, WA-4E-2, 8, 17; Community 5: CH-3E-30, CA-6EE-16, 19

Family Hapsiphyllidae

Genus _Amplexizaphrentis_ Vaughan, 1906

Amplexizaphrentis spinulosus (Milne-Edwards & Haime, 1851)

Plate 2, figures 7, 12

1851 _Zaphrentis spinulosa_ Milne-Edwards & Haime, p. 334, pl. 5, figs. 7, 7a.

Description: Small to large solitary corals with rugose epitheca. Septa wavy with incomplete tabulae. Spine bases more or less regularly arranged on epitheca.

Distribution: Community 4: F-1W-35, F-2E-1, 2, 17, CH-2E-18, CH-2W-19, WA-3E-12, WA-4E-8, 20, WH-5EE-3, CA-6EE-3; Community 5: CH-2W-10, CH-3E-28, 30, WA-3E-8, 9, CA-6EE-4, 7, 10, 16

<u>Amplexizaphrentis</u> species

Plate 2, figures 13, 14

<u>Description</u>: Like <u>A</u>. <u>spinulosus</u>, but without spine bases on epitheca.

<u>Distribution</u>: Community 4: F-1E-22; Community 5: CH-3E-30, WA-4E-11, WH-5E-5, CA-6EE-16

Genus <u>Zaphrentoides</u> Stuckenberg, 1895

<u>Zaphrentoides</u> species

Plate 2, figures 1-3, 9

<u>Description</u>: Trochoid to ceratoid solitary corals with prominent fossula and reduced minor septa.

<u>Distribution</u>: Community 4: CH-2W-2, WA-3E-15; Community 5: CH-3E-30, WA-3E-8, 16

Unidentified hapsiphyllids

Plate 2, figure 8

<u>Description</u>: Trochoid to ceratoid solitary corals with sell developed fossula, minor septa not reduced, poorly developed tabulae.

<u>Discussion</u>: Most specimens are poorly silicified fragments lacking preserved internal structures.

<u>Distribution</u>: Community 4: F-1E-14, 22, 36, F-1W-2, 35, F-1WW-1, 3, 4, F-2E-1, 2, 17, 22, F-2W-1, 3, F3EE-3, 4, CH-2E-4, 17, 18, 23, CH-2W-2, 9, 19, CH-3E-2, 4, 7, WA-3E-11, 12, 15, WA-4E-2, 4, 5, 8, 9, 11, 17, 20, 21, 23, 24, 25, WH-5EE-3, CA-6EE-3, 11, 14, 18; Community 5: CH-2E-20, CH-2W-10,

CH-3E-1, 3, 28, 30, WA-3E-8, 9, 16, WA-4E-22, WH-5E-5, CA-6EE-4, 7, 10, 16, 19

Superfamily Zaphrenticae

Family Lithostrotionidae

Genus Lithostrotion Fleming, 1828

Lithostrotion proliferum Hall, 1858, p. 668

Plate 2, figures 17, 18

Description: Small to large phaceloid colonial corals. Columella present with conical tabulae, small dissepimentarium. New corallites form by budding.

Distribution: Community 4: WA-4E-17, 20, CA-6EE-9, 18; Community 5: CH-3E-30, WA-3E-1, CA-6EE-2, 8, 16, 19

* Lithostrotion (Siphonodendron) genevievensis Easton, 1957, p. 616

Plate 2, figures 19, 20

Description: Cylindrical, small, phacelloid colonial corals with simple columella, rather flattened tabulae, few dissepiments. Epitheca rugose.

Distribution: Community 5: CH-2W-10, CA-6EE-16

Family Aulophyllidae

Genus Koninckophyllum Thomson & Nicholson, 1876, p. 297

Koninckophyllum species

Plate 2, figures 15, 16, 21

Description: Medium to large, solitary corals with columella, incomplete tented tabulae, and large dissepimentarium.

Distribution: Community 5: WA-3E-1, 8

Suborder Columnariina

Family Lonsdaleiidae

Genus Acrocyathus d'Orbigny, 1849

Acrocyathus sp. cf. A. floriformis d'Orbigny, 1849, p. 12

Plate 2, figures 22, 23

Description: Cerioid colonial corals with columella and large lonsdaleoid dissepimentarium. Tabulae tented or conical.

Discussion: Easton (1973) has shown the common Mississippian species Lithostrotionella castelnaui Hayasaka to be a junior synonym of Acrocyathus Floriformis d'Orbigny, therefore Easton's conclusions have been followed here instead of L. castelnaui of authors.

Distribution: Community 5: CH-3E-1, WA-3E-9

Order Tabulata

Family Chaetitidae

Genus Chaetetes Fischer, 1829, p. 160

Chaetetes species

Plate 3, figures 17-21

Description: Massive to encrusting coralla composed of numerous small (approximately .5 mm) diameter, polygonal corallites with more or less regularly spaced complete tabulae.

Distribution: Community 4: WA-3E-12; Community 5: CA-6EE-4, 10, 19

Family Favositidae

Subfamily Pachyporinae

Genus Striatopora Hall, 1851

Striatopora species

Plate 3, figures 2, 3, 9

Description: Ramose coralla bearing numerous corallites surrounded by thickened walls at surface. Striations may partially surround each corallite on surface of colony.

Distribution: Community 4: F-1WW-1; Community 5: CH-3E-30

Subfamily Micheliniinae

Genus Michelinia de Koninck, 1841, p. 30

Michelinia species

Plate 3, figures 22-27

Description: Hemispherical to planated coralla bearing circular to polygonal corallites. Tabulae incomplete, mural pores present, with rugose epitheca.

Discussion: Specimens from the Floyd Shale may represent several species. The most notable differences are polygonal versus circular corallites and planated versus hemispherical coralla.

Distribution: Community 4: F-1W-35, F-2E-17, F-3EE-3, CH-2E-18, CH-2W-2, CH-3E-7, WA-3E-11, 12, WA-4E-2, 17, 18, 20, CA-6EE-3, 5; Community 5: CH-2W-10, CH-3E-1, 3, 30, WA-3E-1, 8, WA-4E-11, 22, CA-6EE-2, 4, 8, 16

Subfamily Palaeacinae

Genus _Palaeacis_ Milne-Edwards & Haime, 1857

Palaeacis cuneiformis Milne-Edwards, 1860, p. 171

Plate 3, figures 4-7, 11, 16

Description: Wedge-shaped, upright coralla with a single row of corallites along sides and top with mural pores. No tabulae. External surface canaliculate.

Distribution: Community 4: CH-2W-2, WA-4E-20; Community 5: CH-2W-10, WA-3E-16, WA-4E-22, CA-6EE-19

Palaeacis species

Plate 3, figures 10, 15

Description: Recumbant coralla bearing at least four corallites. Abundant, regularly arranged mural pores, no tabulae.

Discussion: Lack of tabulae suggests _Palaeacis_. The external surface of the colony is not preserved.

Distribution: Community 4: WA-4E-20

Family Auloporidae

Subfamily Auloporinae

Genus _Cladochonus_ M'Coy, 1847

Cladochonus beecheri (Grabau, 1899)

Plate 3, figures 12-14

Description: Trumpet-shaped branching corallites. Slightly scalloped or entire calical rim.

Distribution: Community 5: CH-3E-30, WH-5E-5, CA-6EE-16

Subfamily Syringoporinae

Genus Syringopora Goldfuss, 1826

Syringopora species

Plate 3, figures 1, 8

Description: Thin, subcylindrical, interconnected corallites with smooth exteriors, except for connecting tubules.

Discussion: Internal structures are not preserved in the only colony collected, but the generic assignment is certain.

Distribution: Community 4: F-1E-22, F-2W-3

Phylum Bryozoa

Class Gymnolaemata

Order Cyclostomata

Family Fistuliporidae

Genus Fistulipora M'Coy, 1850

"Fistulipora" species

Plate 4, figures 9, 11-13, 16, 18, 19, 21

Description: Encrusting, lamellate or ramose zoaria with rounded zooecia and straight diaphragms. Some types with monticules or maculae.

Discussion: Nearly all lamellate, encrusting, and ramose bryozoans from the Floyd Shale generally appear to be fistuliporids on the basis of external appearance and rare fortuitous weathered sections. Sectioning was not feasible because of poor preservation, and it is likely that many specimens have been incorrectly assigned to this genus.

Distribution: (Ramose) Community 2: F-1E-12; Community 4: F-1E-22, F-1W-2, 35, F-1WW-1, F-2E-1, 2, 17, F-2W-3, F-3EE-3, WA-3E-15, CA-6EE-3; Community 5: CH-3E-1, WA-3E-9. (Bifoliate and encrusting) Community 2: F-1E-2, F-2E-3; Community 4: F-1E-22, F-2E-1, 2, F-2W-3, CH-2E-17, 18, CH-2W-9, WA-3E-15, WA-4E-20, 23, CA-6EE-3, 14; Community 5: CH-3E-30, WA-3E-8, WA-4E-11, 22, CA-6EE-2, 7

Family Hexagonellidae

Genus Glyptopora Ulrich, 1884

Glyptopora species

Plate 4, figure 20

Description: Thin, foliate sections joined by thickened ribs of noncellular? material. Surfaces of folia with small, teardrop-shaped maculae.

Distribution: Community 4: WA-4E-2

Genus Meekopora Ulrich, 1889, p. 483

Meekopora? species

Plate 4, figures 14, 15

Description: Flattened, ramose zoaria with circular zooecia, with maculae.

Discussion: The only collected specimen is not sufficiently well preserved to show internal details, and is tentatively assigned to Meekopora.

Distribution: Community 5: WA-4E-22

Order Cryptostomata

Family Fenestellidae

Genus Fenestella Lonsdale, 1839

"Fenestella" species

Plate 4, figures 23, 26

Description: Fan-like reticulate expansions with open fenestrules between successive upright branches and dissepiments. Two rows of zooecia on each branch, with variable number of zooecia flanking each fenestrule.

Discussion: Specimens assigned to this genus include nearly all fenestrate bryozoans collected, and many specimens may actually be frond fragments of related genera such as Archimedes or Liropora.

Distribution: Community 1: WH-5E-1, G-2EE-1; Community 2: F-1E-12, 16, F-1W-16, F-2E-3, 57, F-2EE-20, CH-2E-19, 22, CH-2W-7, CH-3E-25, WA-4E-26, WH-5E-2, G-2EE-14; Community 3: F-2E-12, 28, F-2W-2, CH-2W-16, CA-6EE-12, 13; Community 4: F-1WW1, F-2E-1, 2, CH-2E-4, 17, 23, CH-3E-2, 4, WA-3E-15, WA-4E-2, 5, 9, 17, 20, 21, 23, WH-5EE-3, CA-6EE-3, 5, 11; Community 5: CH-2E-20, CH-2W-10, CH-3E-1, 3, WA-3E-9, CA-6EE-7, 8

Genus Archimedes Owen, 1838

Archimedes species

Plate 4, figures 1, 2, 5, 10

Description: Spiral, noncelluliferous axes bearing Fenestella type fronds along the spiral margin.

Distribution: Community 2: CH-2E-19, 22; Community 4: F-2W-1, CH-2E-23, CH-2W-2, CH-3E-7, CA-6EE-3, 5, 11; Community 5: CH-2E-20, WA-4E-22, CA-6EE-4, 10; Unidentified Community: CH-2E-21

Genus Lyropora Hall, 1857, p. 179

"Lyropora" species

Plate 4, figures 3, 4, 6-8

Description: Thick, straight or curved, noncelluliferous axes bearing Fenestella type frond along the tapered lateral margin.

Discussion: Bassler (1953, p. G124) listed the two related genera Lyropora and Lyroporella, which he differentiated by the number of rows of zooecia born by the noncellular axis. None of the specimens from the Floyd Shale are preserved with the emergent fronds attached, making generic assignment impossible, although they are of this basic type.

Distribution: Community 4: F-1W-2, F-1WW-1, 3, 4, F-2W-1, CH-2W-9, WA-3E-11, WA-4E-2, 20, 24, CA-6EE-9, 14, 18; Community 5: CH-2W-10, CH-3E-28, 30, WA-4E-11, WH-5E-5, CA-6EE-4, 19

Genus Polypora M'Coy, 1844, p. 206

Polypora species

Plate 4, figure 25

Description: Similar to Fenestella, but with more than two rows of zooecia along each branch.

Distribution: Community 2: CH-2E-19

Family Acanthocladiidae

Genus *Penniretepora* d'Orbigny, 1849

Penniretepora species

Plate 4, figure 17

Description: Slender branches bearing short, oblique side branches, not forming fenestrules.

Distribution: Community 4: F-2E-2

Family Rhabdomesidae

Genus *Rhombopora* Meek, 1872, p. 141

Rhombopora species

Plate 4, figures 22, 23

Description: Slender, ramose axes bearing zooecia with circular to oval apertures. Zooecia arranged in oblique rows, commonly with acanthopores around individual zooecia.

Discussion: Specimens collected from the Floyd Shale were too small to facilitate easy sectioning, but the generic diagnosis appears certain. The small axes in the figured specimens may not belong in *Rhombopora*.

Distribution: Community 5: CH-3E-1

Family Sulcoreteporidae

Genus *Sulcoretepora* d'Orbigny, 1847

Sulcoretepora species

Plate 4, figure 24

Description: Flattened, ribbon-like axes that may bifurcate. Small circular to oval zooecia may be regularly arranged in oblique rows on surfaces of axis.

Discussion: Specimens collected closely resemble illustrations of *Cystodictya* Ulrich, which Bassler (1953, p. G142) listed as a synonym of *Sulcoretepora*.

Distribution: Community 2: F-1E-16; Community 4: WA-4E-4, CA-6EE-3, 5

Phylum Brachiopoda

Class Inarticulata

Order Lingulida

Family Lingulidae

Genus *Lingula* Bruguiere, 1797

Lingula aff. *L. carbonaria* Shumard, 1858, p. 215

Plate 5, figures 1, 2

Description: Small, oval, elongate shells that are slightly convex. Ornament of fine, concentric growth lines.

Discussion: *L. carbonaria* is a very common Carboniferous species, and the external features of Floyd Shale specimens generally resemble it. Preservation, however, is relatively poor, and shells could not be separated from the enclosing rocks to study internal features.

Distribution: Community 1: F-1E-30, F-1W-11, 23, 33, F-2E-13, F-2EE-3, 19, F-3EE-1, 5, CH-2W-13, WH-5E-1, G-2EE-1

Genus *Trigonoglossa* Dunbar & Condra, 1932, p. 35

? *Trigonoglossa* species

Plate 5, figure 3

Description: Rounded subtrigonal, flattened to slightly convex shells with concentric, raised lines.

Discussion: Dunbar and Condra's specimens were much better preserved than those from the Floyd Shale and show distinct raised concentric lines. Specimens from the Floyd Shale give the appearance of having flattened concentric laminae, but this may be due to preservation.

Distribution: Community 2: F-2E-3

Order Acrotretida

Suborder Acrotretidina

Family Discinidae

Subfamily Orbiculoideinae

Genus *Orbiculoidea* d'Orbigny, 1847, p. 269

Orbiculoidea species

Plate 5, figures 4-6

Description: Shell subcircular with low conical brachial valve and flat to slightly conical pedicle valve. Apices of valves and pedicle opening slightly posterior. Valves may show concentric fine ridges with flat inter-ridge areas.

Discussion: Most specimens are disarticulated conical brachial valves or flattened pedicle valves.

Distribution: Community 2: F-0E-1, F-1E-12, F-2E-3, 55, CH-2W-7; Community 4: CH-2E-18

Subfamily Disciniscinae

Genus Oehlertella Hall & Clarke, 1890, p. 133

Oehlertella species

Plate 5, figure 10

Description: Superficially similar to Orbiculoidea, but with apex of the brachial valve strongly directed posteriorly.

Discussion: Some specimens assigned to Orbiculoidea may in fact belong in Oehlertella, but only one locality yielded obvious Oehlertella.

Distribution: Community 2: F-1E-26

Suborder Craniidina

Family Craniidae

Genus Crania Retzius, 1781, p. 72

Crania species

Plate 5, figure 11; Plate 6, figure 17

Description: Irregularly cap shaped brachial valves bearing irregular concentric growth lines. Pedicle valves not observed.

Discussion: All specimens of Crania were observed attached to productid and strophomenid brachiopod shells by cementation, only exposing the brachial valve.

Distribution: Community 2: F-2E-3; Community 4: F-1W-2, CH-2E-18, CH-2W-2, WA-3E-15

Class Articulata

Order Orthida

Suborder Orthidina

Family Enteletidae

Genus Schizophoria King, 1850, p. 105

Schizophoria species

Plate 6, figure 9

Description: Shell medium to large, subelliptical in plain view. Slightly convex to flat pedicle valve contains large, suboval muscle scars surrounded by elevated rims. Brachial valve strongly convex.

Discussion: The specimen illustrated is very poorly preserved, showing the mold of the pedicle valve and small parts of the inflated brachial valve.

Distribution: Community 4: CH-3E-2, WA-4E-4, 11

Family Rhipidomellidae

Genus Rhipidomella Oehlert, 1890

Rhipidomella species

Plate 6, figures 5-7, 10, 11

Description: Subcircular to suboval shell with lenticular cross section. Short hinge line with large cardinal process filling delthyrium. Ornament of fine radiating costae or costellae that appear to be hollow in some specimens.

Discussion: The inferred shape of (1046TX3) (Plate 6, figures 7, 11) may be subtriangular, and this specimen may actually belong in a related genus.

Distribution: Community 5: CA-6EE-2, 4

Genus Perditocardinia Schuchert & Cooper, 1931

Perditocardinia dubia (Hall, 1858)

Plate 6, figures 1-4

1856 Orthis dubia Hall, p. 12

1906 Rhipidomella dubia (Hall) Beede, p. 1303-1304, pl. 22, fig. 1-5

1932 Perditocardinia dubia (Hall) Schuchert & Cooper, p. 232, pl. 19, figs. 12, 16, 17, 20-22.

Description: Small, subovate to subtriangular shell with large cardinal process and small hinge line as in Rhipidomella. Ornament of very fine costellae or capillae.

Discussion: All specimens of this species are disarticulated valves; the most common being pedicle valves bearing a large pedicle opening that was filled in life by the large cardinal process.

Distribution: Community 4: F-1W-35, F-1WW-3, F-3EE-3, WA-4E-8, 9, CA-6EE-18; Community 5: CH-2W-10, CH-3E-30, CA-6EE-16

Order Strophomenida

Suborder Strophomenidina

Family Meekellidae

Genus Schellwienella Thomas, 1910, p. 92

Schellwienella species

Plate 6, figure 14

Description: Large resupinate shells with delthyrium closed by a deltidium. Medium septum absent, ornament consisting of closely spaced costae.

Discussion: Weller (1914, p. 59) suggested that the resupinate shell is an important feature for differentiation Schellwienella from Schuchertella.

Distribution: Community 2: CH-3E-3

Family Schuchertellidae

Genus Schuchertella Girty, 1904

Schuchertella costatula (Hall & Clarke, 1892)

Plate 6, figures 15, 17, 20, 21

1892 Derbya (?) costatula Hall & Clarke, p. 346, pl. 11B, fig. 16-17

* 1914 Schuchertella costatula (Hall & Clarke) Weller, p. 57-58, pl. 2, fig. 19-22.

Description: Small to medium broad shells lacking a median septum in the pedicle valve and with the delthyrium closed by a deltidium. Ornament of several strong radiating costae among which are many fine radiating costae. Costae less apparent in the cardinal extremities.

Discussion: This species is extremely abundant at WA-3E-15, but very rare elsewhere in the Floyd Shale.

Distribution: Community 4: WA-3E-15, CA-6EE-3; Community 5: CA-6EE-4

Schuchertella species

Plate 6, figure 16

Description: Slightly biconvex shells with a large delthyrium in the pedicle valve closed by a deltidium. No median septum in pedicle valve. Ornament of thin to thick regular costae.

Distribution: Community 4: F-2E-17, CH-2E-17, 18, CH-2W-2, 19; Community 5: WA-3E-8, 9

Family Orthotetidae

Genus Orthotetes Fischer, 1829

Orthotetes kaskaskiensis (McChesney, 1860)

Plate 6, figures 18, 19

1860 Orthis kaskaskiensis McChesney, p. 31.

* 1914 Orthotetes kaskaskiensis (McChesney) Weller, p. 77-78, pl. 6, fig. 1-15.

Description: Medium to large shells with a subelliptical outline. Pedicle beak commonly producing a slight concavity to the anterior. Delthyrium closed by strongly convex deltidium, median septum present. Ornament ranges from costae to costellae.

Discussion: The presence of a median septum in the pedicle valve and the finer ornament distinguishes this species from other strophomenids in the Floyd Shale.

Distribution: Community 2: F-1E-2, F-2EE-20, G-2EE-14; Community 4: CH-2E-18, WA-4E-4, 18, 20, 23, CA-6EE-14; Community 5: CH-3E-1,30

Unidentified Strophomenids

Plate 4, figure 23

Description: Small fragments of strophomenid shells.

Distribution: Community 2: F-2E-55; Community 4: F-2E-2, 22, CH-2W-19, CH-3E-2, WA-4E-8, 17; Community 5: CH-2W-10; Unidentified Community: CH-3E-17

Suborder Chonetidina

Family Chonetidae

Genus *Chonetes* Fischer, 1830

* *Chonetes cheserensis* Weller, 1914, p. 83

Plate 6, figures 8, 12, 13

Description: Concavo-convex shells with very small beak and a row of spines along hinge line. Largest dimension is length of hinge. Ornament of numerous radiating costellae.

Distribution: Community 2: F-1E-9, 12, 26, 41, F-1W-1, F-2E-3, 57, WH-5E-2, G-2EE-14; Community 3: F-2E-28; Community 4: F-2E-17, CH-2W-2, CH-3E-2, WA-3E-12, 15, WA-4E-24, CA-6EE-3, 14

Suborder Productidina Waagen, 1883

Superfamily Strophalosiacea

Family Strophalosiidae Schuchert, 1913

Genus *Heteralosia* King, 1938, p. 278

Heteralosia species

Plate 6, figures 22-24

Description: Circular to subcircular shells with moderately convex pedicle valve and slightly concave brachial valve. Ornament of tubular, recumbent and erect spines. No spines on brachial valve.

Distribution: Community 2: F-1E-12, F-2E-3; Community 4: F-1E-36, CH-2E-17

Superfamily Productacea

Family Overtoniidae

* Genus Laminatia Muir-Wood & Cooper, 1960, p. 189

Laminatia? species

Plate 7, figure 13

Description: Pedicle valve slightly convex bearing lamellose bands that support two rows of fine recumbent spines.

Discussion: The only collected specimen is a fragment of a pedicle valve resembling Muir-Wood and Cooper's (1960, p. 189) description. The lamellae supporting the spines distinguish this form particularly from Echinoconchus, with which this fragment might otherwise be confused. Lack of more complete material precludes a definite assignment. The range of this genus is reported as Upper Devonian (Muir-Wood and Cooper, 1960, p. 190).

Distribution: Community 4: WA-4E-17

Family Marginiferidae

Genus *Inflatia* Muir-Wood & Cooper, 1960

Inflatia inflata (McChesney, 1860)

Plate 7, figures 1, 2, 4-6

1860 *Productus inflatus* McChesney, p. 40.

* 1944 *Dictyoclostus inflatus* (McChesney) Cooper, *in* Shimer & Shrock, p. 350, p. 136, fig. 9-14.

* 1960 *Inflatia inflata* (McChesney) Muir-Wood & Cooper, p. 389, pl. 55, fig. 1-15.

Description: Medium to large shells, inflated posteriorly, with beak protuberant above hinge. Ornament of radiating costae with concentric rugae present in the posterior part of the valves. Spines located on hinge margin of pedicle valve and a few scattered on pedicle valve. Internal pedicle valve with deep, flabellate muscle scars.

Discussion: Specimens were assigned to this species on the basis of hinge spines and large, tubular spine bases scattered on the pedicle valve.

Distribution: Community 2: F-0E-1, F-1E-9, 12, 16, F-2E-3, 57, F-2W-2, CH-3E-3, G-2EE-14; Community 4: F-1E-14, 22, 36, F-1WW-3, F-2E-1, 2, 22, F-2W-1, F-3EE-3, CH-2E-18, CH-2W-9, CH-3E-2, 4, WA-3E-12, 15, WA-4E-2, 4, 17, 18, 20, WH-5EE-3, CA-6EE-3; Community 5: CH-3E-30, WA-3E-8, 9, 16, CA-6EE-4, 16

Family Echinoconchidae

Genus Echinoconchus Weller, 1914

Echinoconchus alternatus (Norwood & Pratten, 1855)

Plate 7, figures 20, 26

1855 Productus alternatus Norwood & Pratten, p. 20, pl. 2, fig. la-e.

* 1914 Echinoconchus alternatus (Norwood & Pratten) Weller, p. 138-140, pl. 17, fig. 1-7.

Description: Large shell with narrow, upcurved beak. Brachial valve flat to slightly concave with pedicle valve strongly convex. No rugae or costae, but shell is ornamented with small, fine concentric spine ridges on both valves.

Discussion: All large Echinoconchus from the Floyd Shale appear to belong in this species.

Distribution: Community 2: CH-3E-3; Community 4: F-2E-17, 22, F-2W-1, CH-2E-18, CH-2W-9, WA-4E-4, 23, CA-6EE-3

Echinoconchus species

Description: Small shells with shape of Echinoconchus and bands of spines.

Distribution: Community 4: CH-2W-2, WA-4E-21

Echinoconchus biseriatus (Hall, 1856)

Plate 7, figures 9-11, 14-16, 18, 19

* 1856 Productus biseriatus Hall, p. 12.

* 1914 Echinoconchus biseriatus (Hall) Weller, p. 141, pl. 17, figs. 10-15.

* 1960 Stegacanthia? biseriata (Hall) Muir-Wood & Cooper, p. 199, pl. 52, figs. 1-6.

Description: Small, subequal shells ranging from subovoid to subcircular. Hinge line shorter than greatest width. Pedicle valve strongly convex, not sulcate; brachial valve slightly concave. Ornament of regular, concentric spine bands, not supported by lamellae, but slightly raised anteriorly. Spines recumbent, directed anteriorly, forming one or two rows per band and present on brachial and pedicle valves. Beak curved upward above hinge. Spine bands become faint and eventually obsolescent posteriorly.

Discussion: No noticeable differences exist between Floyd Shale specimens and specimens illustrated by Weller (1914, pl. 18, figs. 10-15), hypotypes illustrated by Sutton (1938, pl. 66, figs. 5-7) and by Muir-Wood and Cooper (1960, p. 52, figs. 1-6).

Muir-Wood and Cooper (op cit, pp. 198-200) erected the genus Stegacanthia with S. bowsheri Muir-Wood and Cooper as the type. They suggested that specimens of Productus biseriatus Hall possibly belonged in Stegacanthia. In their description of the new genus, Muir-Wood and Cooper stated that the pedicle valve was slightly convex and that ornament consisted of spine ridges set on lamellose bands that anteriorly became squamose and overlapped. None of the specimens illustrated by Weller, Sutton, or Muir-Wood and Cooper assigned to "biseriatus" have lamellae or squamose or overlapping bands. Thus, they may belong in Echinoconchus as supposed by Weller.

Distribution: Community 4: F-2E-1, 2

Family Buxtoniidae

Genus Flexaria Muir-Wood & Cooper, 1960

Flexaria arkansana (Girty, 1910)

Plate 7, figures 17, 21, 23, 24

1910 Productus arkansanus Girty, p. 216-217.

* 1935 Buxtonia arkansana (Girty) Hernon, p. 681.

* 1960 Flexaria arkansana (Girty) Muir-Wood & Cooper, p. 401-402, pl. 78, fig. 1-18; pl. 123, fig. 18-21.

Description: Rounded subtrigonal shell with small visceral disc. Convex pedicle valve and slightly concave brachial valve. Ornament of rounded costae on which are based small, anteriorly directed spines. Group of spines on ears.

Distribution: Community 2: F-1E-2, 26, F-1W-16; Community 4: F-2E-1, WA-3E-15, CA-6EE-3

Genus Protoniella Bell, 1929

Protoniella parva (Meek & Worthen, 1860)

Plate 7, figures 22, 25

1860 Productus parvus Meek & Worthen, p. 450.

* 1960 Protoniella? parva (Meek & Worthen) Muir-Wood & Cooper, p. 408, pl. 91, fig. 8-13.

Description: Small, arched shell, equidimensional in plan view. Ornament of fine radiating costae, few if any concentric rugae posteriorly, and a few small spine bases scattered on pedicle valve.

Distribution: Community 4: F-1W-2

Family Linoproductidae

Genus Ovatia Muir-Wood & Cooper, 1960

Ovatia ovata (Hall, 1858)

Plate 7, figures 3, 7, 8

1858 Productus ovatus Hall, p. 674, pl. 24, fig. 1.

1934 Linoproductus ovatus (Hall) Benson, p. 63-64.

* 1960 Ovatia ovata (Hall) Muir-Wood & Cooper, p. 419, pl. 114, fig. 5.

Description: Thin, small to large shell, with beak strongly protruding above hinge line. Strongly arched, ornamented by fine radiating irregular costae with a few small spine bases. Ears commonly rugose, but rugae incomplete in beak area.

Discussion: Most shells and fragments with very fine costae have been assigned to this species.

Distribution: Community 1?: G-2EE-1; Community 2: F-1E-2, 46, F-2E-3, CH-3E-25, G-2EE-14; Community 3: F-2E-28; Community 4: F-1E-36, F-2E-2, CH-2W-2, WA-4E-4, CA-6EE-3; Community 5: CH-3E-1, 30, WA-3E-8, 9, 16, WA-4E-22

Ovatia? species

Plate 7, figure 12

Description: Similar to Ovatia, but costae are more regular and rugae are complete on posterior of pedicle valve.

Distribution: Community 4: WA-4E-4

Unidentified productids

Plate 5, figure 11

Description: Fragments of shells showing radiating costae commonly intersected by concentric rugae.

Discussion: Lack of completeness precludes generic identification, but many of these fragments may belong in *Inflatia inflata*.

Distribution: Community 2: F-1E-16, F-1W-16, 53, CH-2E-19, CH-2W-7, CH-3E-3, 25, WA-4E-26; Community 3: F-2E-28; Community 4: F-1E-14, 36, F-1W-2, F-2E-2, 17, 22, F-2W-1, F-3EE-3, CH-2E-17, 18, 23, CH-2W-2, 9, CH-3E-2, WA-3E-11, 15, WA-4E-2, 4, 5, 17, 23, WH-5EE-3, CA-6EE-3, 18; Community 5: CH-2W-10, CH-3E-1, 3, 30, WA-3E-8, 9, 16, WA-4E-11, 22, WH-5E-5, CA-6EE-2, 4, 7, 19; Unidentified Community: WA-3E-13

Order Rhynchonellida

Family Uncertain (?aff. Pugnacidae)

Genus *Pugnoides* Weller, 1910

Pugnoides ottumwa (White, 1862)

Plate 5, figures 12-15, Plate 16, figure 2

1862 *Rhynchonella ottumwa* White, p. 23.

1910 *Pugnoides ottumwa* (White) Weller, p. 512, fig. 13.

Description: Small, subpentagonal to subtriangular shells. Ornamented by simple plications becoming very subdued posteriorly. Two to three plications in sulcus with four to five on each flank.

Discussion: Specimens are either too crushed or poorly silicified to examine for critical internal structures, but the specific designation is fairly certain based on external features.

Distribution: Community 2: F-2EE-13, F-2E-55; Community 4: F-1W-2; Unidentified Community: F-1E-1

Family Camarotoechiidae

Genus *Leiorhynchoidea* Cloud, 1944

Leiorhynchoidea carboniferum (Girty, 1911)

Plate 5, figures 7-9

1911 *Liorhynchus carboniferum* Girty, p. 54-59, pl. 6, fig. 1-8; pl. 7, fig. 13-16.

1915 *Leiorhynchus carboniferum* Girty, Snider, p. 86-87.

* 1965 *Leiorhynchoidea carboniferum* (Girty) Schmidt & McLaren, p. H581.

Description: Medium sized, subpentagonal shells with fold and sulcus containing three or four low rounded plicae. Flanks unornamented except for a few concentric growth lines.

Distribution: Community 2: F-1E-24, F-1W-53; Unidentified Community: F-1E-43

Unidentified rhynchonellids

Description: Fragments, molds and crushed rhynchonellid shells.

Distribution: Community 2: F-1E-2, 12, 26, 38, F-1W-1, F-2EE-13, F-2E-55, CH-3E-3; Community 3: CA-6EE-13; Community 5: CH-2E-20

Order Spiriferida

Suborder Retziidina

Family Retziidae

Genus Eumetria Hall, 1864

Eumetria vera (Hall, 1858)

Plate 9, figures 17, 24, 28, 29

1858 Retzia vera Hall, p. 657, pl. 23, fig. 1a-d.

* 1914 Eumetria vera (Hall) Weller, p. 444-445, pl. 76, fig. 13-17.

Description: Small to medium slightly elongate ovate shells. Valves subequally convex, foramen large, circular. Ornament consists of fine radiating costae.

Distribution: Community 2: F-1E-12; Community 4: F-1E-22, F-1WW-1, F-2E-1, 2, 17, F-2W-3, F-3EE-4, CH-2W-2, 9, WA-4E-25; Community 5: WA-4E-22

Eumetria costata (Hall, 1858)

Plate 9, figures 30, 31, 33

1858 Retzia vera var. costata Hall, p. 704, pl. 27, fig. 3a, b.

* 1914 Eumetria costata (Hall) Weller, p. 445-447, pl. 76, fig. 25-29.

Description: Like that of *E. vera*, but shell slightly more elongate and costae much coarser and fewer in number.

Distribution: Community 2: F-2E-3; Community 4: CH-2E-18, CH-ZW-19, WA-3E-15, WA-4E-2; Community 5: CH-3E-1, 30, CA-6EE-4, 10

Suborder Athyrididina

Family Athyrididae

Genus *Cleiothyridina* Buckman, 1906

Cleiothyridina sublamellosa (Hall, 1858)

Plate 9, figures 25-27, 32, 34

1858 *Athyris sublamellosa* Hall, p. 702, pl. 27, fig. la-c.

* 1914 *Cliothyridina sublamellosa* (Hall) Weller, p. 482-484, pl. 80, fig. 31-60.

* 1944 *Cleiothyridina sublamellosa* (Hall) Cooper, in Shimer & Shrock, p. 333-335, pl. 128, fig. 3-5.

Description: Small, subcircular to slightly elongate shell with subequally convex valves. Ornament of imbricate concentric lamellae that terminate anteriorly in flattened spine frills.

Discussion: This species differs only slightly from *C. hirsuta* (Hall), which is more characteristic of the Meramecan (Weller, 1914, p. 480).

Distribution: Community 2: F-2E-3; Community 4: F-1E-14, 36, F-1WW-1, 3, 4, F-2W-1, 3, F-2E-1, 2, 17, 22, F-3EE-4, CH-2E-17, 18, 23, CH-2W-2, 9, 19, CH-3E-2, WA-3E-12, 15, WA-4E-2, 5, 9, 17, 20, 23, 24, WH-5EE-3, CA-6EE-3, 5;

Community 5: CH-3E-1, 3, 28, 30, WA-3E-8, 9, WA-4E-11, 22, CA-6EE-2, 4, 7, 10, 16

Genus Composita Brown, 1849

Composita subquadrata (Hall, 1858)

Plate 9, figures 15, 16, 20, 23

1858 Athyris subquadrata Hall, p. 703, pl. 27, figs. 1a-d, pl. 708, fig. 118.

1903 Semimula subquadrata (Hall) Girty, p. 296-298, pl. 1, fig. 5.

* 1914 Composite subquadrata (Hall) Weller, p. 489-490, pl. 81, fig. 1-15.

Description: Small to medium, suboval to subquadrate shells, with distinct fold and sulcus. Valves subequally convex. Ornament, if present, of concentric growth lines.

Discussion: Weller (1914, p. 489-490) states that this species may commonly be mistaken for C. trinuclea (Hall). Most specimens appear closer to C. subquadrata, but many are too badly compressed to allow definite specific assignment.

Distribution: Community 2: F-1E-2, F-2E-3; Community 4: WH-5EE-3, F-1WW-1, F-1W-2, F-2E-17, CH-2W-9, CH-3E-2, WA-3E-15, WA-4E-2, CA-6EE-3; Community 5: WA-3E-9, 16, CA-6EE-4,7

Composita species A

Plate 9, figures 18, 19, 21, 22

Description: Very small, suboval to subtriangular shells with fairly well developed fold and sulcus. Brachial valve more convex than pedicle valve, both valves unornamented.

Discussion: The small size and general outline distinguishes these specimens from other Floyd shale Composita. Although they may represent juvenile stages of a larger species, no specimens larger than those illustrated were observed.

Distribution: Community 4: F-2E-1, 2

Composita species indeterminate

Description: Fragments or molds, commonly crushed, of Composita.

Distribution: Community 1: F-1W-23; Community 2: F-0E-1, F-1E-12, 26, 38, 46, F-1W-1, F-2E-55, WA-4E-26; Community 3: F-2E-28, CA-6EE-12, 13; Community 4: F-1E-36, F-1WW-3, F-2W-1, F-2E-22, F-3EE-3, CH-2E-17, 18, 23, CH-2W-2, CH-3E-4, 7, WA-4E-4, 17, 18, 20, 21, 23; Community 5: CH-2W-10, CH-3E-1, 3, 30, WA-3E-8, WA-4E-22, CA-6EE-2; Unidentified Community: F-1E-1, F-1W-53, F-2EE-13

Unidentified athrids

Description: Shells and fragments that are too poorly preserved to distinguish Cleiothyridina and Composita but belonging in the Athyrididina.

Distribution: Community 2: CH-2E-19; Community 4: F-2W-3, CH-2E-18, 20, 23, CH-3E-4, WH-5EE-3, CA-6EE-3; Community 5: WH-5E-5; Unidentified Community: CH-2E-21

Suborder Spiriferidina

Superfamily Cyrtiacea

Family Ambocoeliidae

Genus *Ambocoelia* Hall, 1860, p. 71

Ambocoelia species

Plate 8, figures 1, 6, 11, 13

Description: Small, subcircular, planoconvex shells. Prominent delthyrium. Pedicle valve unornamented, brachial valve with fine, radiating capillae.

Distribution: Community 4: WA-3E-15

Genus *Crurithyris* George, 1931, p. 42

Crurithyris species

Plate 8, figures 2, 3, 7, 8, 12, 14, 15

Description: Small, wide, suboval, planoconvex shells with prominent delthyrium. Both valves unornamented.

Discussion: The lack of ornament on the brachial valve and the suboval outline were used to separate this genus from *Ambocoelia*.

Distribution: Community 2: F-2E-3, 55; Community 4: CH-2W-9, CH-2E-18, CH-3E-2; Community 5: CH-3E-1, 3, WA-3E-16

Superfamily Spiriferacea

Family Spiriferidae King, 1846

Genus Spirifer Sowerby, 1816

Spirifer arkansanus Girty, 1911, p. 66

Plate 8, figures 27, 29, 30

Description: Large, slightly wider than long shells. Greatest width at hinge line. Fold and sulcus well developed anteriorly, becoming obsolescent posteriorly. Ornament of numerous low, rounded, radiating costae.

Discussion: The preservation of specimens of this species in the Floyd Shale is unusual in that they are rarely silicified.

Distribution: Community 2: F-1E-8, 9, 41, F-2E-3, 25, 57; Community 5: CH-3E-1(?)

Spirifer increbescens Hall, 1858, p. 706

Plate 8, figure 21

Description: Medium sized, wide shell with greatest width at hinge. Pedicle valve more convex than bracial valve. Radiating small, rounded plicae number 14 to 18 on flanks. Well developed fold and sulcus.

Discussion: This species has been reported to be very common in Chesteran faunas, but is rare in the Floyd Shale.

Distribution: Community 5: CH-3E-1

Spirifer leidyi Norwood & Pratten, 1855, p. 72

Plate 8, figures 18-20, 22, 23

Description: Small, wide shells with maximum width at or slightly anterior to hinge. Valve convexity as in *S. increbescens*, but inflation may vary. Plicae small and rounded with about 7 to 10 on each flank.

Discussion: The lower number of plicae on the flanks was used to differentiate *S. leidyi* from *S. increbescens*. This species is very abundant, especially in some Community 4 faunas.

Distribution: Community 2: F-1E-2, 26, 38; Community 4: F-1E-22, 36, F-1WW-1, 3, 4, F-2E-1, 2, 17, 22, F-2W-1, 3, CH-2E-17, CH-2W-2, 9, CH-3E-2,7, WA-3E-15, WA-4E-2, 18, 20, CA-6EE-3; Community 5: CH-2W-10, CH-3E-1, 3, 28, 30, WA-3E-8, 9, 16, WA-4E-22, CA-6EE-4, 16; Unidentified Community: F-2E-11

Spirifer species

Description: Unidentified fragments of *Spirifer*.

Distribution: Community 2: F-0E-1, F-1E-24, G-2EE-14; Community 3: F-2E-12; Community 4: F-1W-2, F-2W-1, F-3EE-3, CH-2E-18, CH-2W-19, CH-3E-2, 4, WA-3E-11, 12, WA-4E-4, 5, 8, 9, 17, 24, WH-5EE-3, CA-6EE-5, 18; Community 5: CH-3E-28, WH-5E-5, WA-4E-11, CA-6EE-2, 7, 19; Unidentified Community: F-1W-53, WA-3E-13

Family Brachythyrididae

Genus Brachythyris M'Coy, 1844, p. 141

Brachythyris species

Plate 8, figures 25, 26, 28

Description: Small to medium subcircular shells. Ornament consists of low, rounded plications on both valves.

Distribution: Community 4: F-1W-35, F-1WW-1, 3, 4, F-2E-1, 17, F-2W-1, F-3EE-3, CH-2E-18, CH-2W-2, 9, 19, CH-3E-4, WA-3E-15, WA-4E-17, WH-5EE-3; Community 5: CH-3E-1, 28, 30, WA-3E-16, WH-5E-5, CA-6EE-4, 16

Superfamily Spiriferinacea

Family Spiriferinidae

Genus Dimegelasma Cooper, 1942

Dimegelasma? species

Plate 9, figures 12-14

Description: Strongly biconvex, subcircular, punctate shells with rounded cardinal extremities. Ornament of low, rounded plicae, no plicae in fold. Shell punctate.

Discussion: The only specimen collected matches Cooper's description fairly well, except that it has spine bases on the brachial valve. The presence of spines suggests some afinity to Reticulariina spinosa (vis), and this specimen may be an aberrant specimen of that species.

Distribution: Community 2: F-2E-3

Genus Punctospirifer North, 1920

Punctospirifer transversus (McChesney, 1860)

Plate 9, figures 4, 7, 8, 10, 11

1860 Spirifer transversa McChesney, p. 42.

* 1914 Spiriferina transversa (McChesney) Weller, p. 297-299, pl. 35, fig. 41-49.

* 1950 Punctospirifer transversa (McChesney) Plummer, pl. 14, fig. 4a-c.

1960 Punctospirifer transversus (McChesney) Easton, p. 295, 311, fig. 8.7:1; 8.16:4.

Description: Small to medium wide shells with maximum width along hinge. Pedicle valve more convex than brachial valve. Sulcus contains one distinct median plication.

Discussion: Some specimens assigned to this species do not have a very well defined plication in the sulcus, and may belong in another species of Punctospirifer.

Distribution: Community 2: F-1E-12, 24, F-2E-3, CH-2E-22, CH-2W-7; Community 3: F-2E-28, CH-2W-16; Community 4: F-1E-36, F-1W-35, F-2E-2, 17, F-3EE-3, CH-2E-17, 18, 23, CH-3E-2, WA-3E-15, WA-4E-24, CA-6EE-3; Community 5: CH-3E-1, 3, 28, 30, WA-3E-8, 9, CA-6EE-4, 7, 16

Genus Reticulariina Fredericks, 1916

Reticulariina spinosa (Norwood & Pratten, 1855)

Plate 9, figures 1-3, 5, 6, 9

1855 Spirifer spinosus Norwood & Pratten, p. 71, pl. 9, fig. 1a-d.

1909 Spiriferina spinosa (Norwood & Pratten) Grabau & Shimer, p. 314-315, fig. 395.

* 1944 Reticulariina spinosa (Norwood & Pratten) Cooper, in Shimer & Shrock, p. 361, pl. 141, fig. 9-13.

Description: Small, wide shells with maximum width along hinge, proportionally less than Punctospirifer transversus. Valve convexity similar to Punctospirifer. Strongly plicate with small spines on crests and sides of plicae.

Distribution: Community 2: F-0E-1, F-1E-2, CH-3E-25; Community 3: F-2E-12; Community 4: F-1W-2, F-1WW-1, F-2W-1, 3, F-2E-1, 2, 17, F-3EE-4, CH-2E-18, 23, CH-2W-2, 19, WA-3E-15, WA-4E-2, 9; Community 5: CH-3E-1, 3, 28, WA-3E-8, WA-4E-11, 22, CA-6EE-4, 7

Superfamily Reticulariacea

Family Elythidae

Genus Torynifer Hall and Clarke, 1894

Torynifer setigera (Hall, 1858)

Plate 8, figures 4, 5, 9, 10, 16, 17

1858 Spirifer setigerus Hall, p. 705, pl. 27, fig. 4a, b.

1906 Reticularia setigerus (Hall) Beede, p. 1318-1319, pl. 21, fig. 1-1a.

1909 Reticularia setigera (Hall) Grabau & Shimer, p. 339, fig. 431 c-d.

* 1944 Torynifer setigera (Hall) Cooper, in Shimer & Shrock, p. 327, pl. 126, fig. 13-15.

<u>Description</u>: Small to large transversely suboval shell. Pedicle valve more strongly convex than brachial valve. Fairly large delthyrium. Ornament of numerous concentric rows of small double-tubed spines. Fold and sulcus poorly to well defined.

<u>Distribution</u>: Community 2: F-1E-2, 12; Community 4: F-1E-22, F-1W-2, F-1WW-1, F-2E-2, CH-2W-2, 9, CH-2E-23, WA-4E-2; Community 5: CH-2W-10, WA-3E-9, WA-4E-22, CA-6EE-7

Order Terebratulida

Family Cranaenidae

Genus *Girtyella* Weller, 1914

Girtyella indianensis (Girty, 1908)

Plate 5, figures 16-18, 21-26

1908 *Harttina indianensis* Girty, p. 293-294, pl. 19, fig. 6-15.

* 1914 *Girtyella indianensis* (Girty) Weller, p. 442, fig. 2.

<u>Description</u>: Small, slightly elongate, suboval shells. Subequally biconvex unornamental valves with bilobed to slightly trilobed anteriors. Commissure rectimarginate to uniplicate.

<u>Distribution</u>: Community 4: F-1W-2, F-1WW-1, F-2E-17, F-2W-1, CH-2E-18, CH-2W-2, 19, WA-4E-2, 20, 23; Community 5: CH-3E-1, 3, 28, WA-3E-8, 9, WA-4E-22

Family Dielasmatidae

Genus Dielasma King, 1859

* Dielasma arkansanum Weller, 1914, p. 269

Plate 5, figures 29-32, 35, 36

Description: Medium sized, suboval, elongate shell. Both valves strongly convex, but pedicle valve more convex than brachial valve. Anterior commissure rectimarginate to uniplicate.

Discussion: Silicified preservation has obscured nearly all internal structures. Two basic anterior commissure types, rectimarginate and uniplicate, may belong to two separate species but all other features are identical.

Distribution: Community 4: WA-4E-2, 23

* Dielasma inflata Weller, 1914, p. 264

Plate 5, figures 33, 37

Description: Small, elongate inflated shells that are commonly geniculate in the midsection of each valve. Shells densely punctate, bearing no ornament.

Discussion: The anterior commissure which is an important feature in this species is not preserved in any specimens collected. Identification is based on the inflated, geniculate valves.

Distribution: Community 2: F-1E-12

Dielasma species

Description: Small dielasmatid shells with rectimarginate commissures.

Discussion: Silicification has obscured internal structures, but these appear to belong in Dielasma.

Distribution: Community 4: F-1W-2, F-1WW-1, F-2E-1, 2, 17, 22, CH-2E-17, CH-3E-2, WA-4E-17; Community 5: CH-3E-1, 30, CA-6EE-7

Dielasma? species

Plate 5, figures 27, 28, 34

Description: Rather small, suboval, slightly elongate shell. Brachial valve less convex than pedicle valve. Valves punctate.

Discussion: Silicification has obscured internal structures, and this form may belong in Dielasma or another related genus.

Distribution: Community 4: F-3EE-3, WA-4E-2, CA-6EE-3

Unidentified Terebratulids

Description: Fragments of terebratulid shells.

Distribution: Community 4: F-1W-35, WA-4E-9, CA-6EE-14; Community 5: CH-2E-20, WA-4E-11, CA-6EE-16

Phylum Mollusca

Class Gastropoda

Order Archaeogastropoda

Superfamily Bellerophontacea

Family Sinuitidae

Genus Euphemites Warthin, 1930, p. 44

Euphemites species

Plate 10, figures 4, 5, 10

Description: Subglobose planispirally coiled conch with numerous spiral cords.

Distribution: Community 2: F-2E-3; Community 4: WA-4E-2

Family Bellerophontidae

Subfamily Bellerophontinae

Genus Bellerophon Montfort, 1808

Subgenus B. (Bellerophon) Montfort, 1808, p. 51

Bellerophon species

Plate 10, figures 1, 2, 7

Description: Globose planispirally coiled conch with slightly crested selinizone; ornament commonly of fine growth lines.

Distribution: Community 4: F-1W-2, F-2E-1, CH-2E-18

Subfamily Knightitinae

Genus Knightites Moore, 1941

Subgenus K. (Retispira) Knight, 1945

* Knightites (Retispira) bellireticulata Knight, 1945, p. 335

Plate 10, figures 3, 8

Description: Subglobose planispirally coiled conch ornamented by strong spiral and collabral cords.

Distribution: Community 2: F-2E-3

Suborder Macluritina

Family Euomphalidae

Genus Straparolus Montfort, 1810, p. 174

Subgenus S. (Euomphalus) Sowerby, 1814, p. 97

Straparolus (Euomphalus) species

Plate 10, figures 9, 11, 15

Description: Discoidal conch with flat spire and widely phaneromphalous base. Upper whorl shoulder angular.

Discussion: The two specimens collected are poorly silicified and do not show any external ornament.

Distribution: Community 4: CH-2E-18

Suborder Pleurotomariina

Family Sinuopeidae

Subfamily Turbonellininae

Genus Rhineoderma de Koninck, 1883

Rhineoderma piasaensis (Hall)

Plate 10, figure 23

1856 Pleurotomaria piasaensis Hall, p. 22

Description: Trochiform conch with very strong spiral and collabral cords.

Discussion: The only collected specimen is compressed and details of the profile are not evident.

Distribution: Community 4: F-2E-2

Rhineoderma species

Plate 10, figures 25, 26

Description: High, trochiform conch with thin spiral and collabral cords that produce small nodes where they cross.

Distribution: Community 2: F-1E-26, F-2E-3

Subfamily Liospirinae

Genus Trepospira Ulrich and Scofield, 1897, p. 957

Subgenus T. (Angyomphalus) Cossmann, 1916, p. 152

Trepospira (Angyomphalus) species

Plate 10, figures 30-33

Description: Lenticular, smooth shell with subsutural nodes and slightly open to cryptomphalus base.

Discussion: T. (Angyomphalus) was reported by Yochelson (1969, p. 29) to be charateristic of the Mississippian, whereas he knew of no T. (Trepospira) earlier than Pennsylvanian. Floyd Shale specimens may belong in T. (Trepospira) because the subsutural nodes do not appear to be elongate radially and the base may be cryptomphalous.

Distribution: Community 2: F-1E-26, F-2E-3, 55

Family Eotomariidae

Subfamily Eotomariinae

Genus Euconospira Ulrich and Scofield, 1897, p. 955

Euconospira species

Plate 10, figures 14, 17, 18, 21, 22

Description: Conical conch with pseudoumbilicus or anomphalus base. Ornament of fine collabral lines.

Discussion: Two basic forms of Euconospira are present in Floyd Shale collections: a broadly euconical form and a more "stairstep" form. Yochelson (1969, p. 31) suggested that the euconical form was more common in the Pennsylvanian, and the other form more common in the Mississippian.

Distribution: Community 4: F-2E-1, 2

Genus Glabrocingulum Thomas, 1940

Subgenus G. (Glabrocingulum) Thomas, 1940

Glabrocingulum (Glabrocingulum) species

Plate 10, figures 16, 19, 20, 24

Description: Turbiniform with rounded concial spire. Ornament of strong spiral cords with faint collabral threads, becoming stronger subsuturally and there intersecting with the spiral cords to produce two to three rows of nodes.

Distribution: Community 2: F-1E-8, F-2E-3, 55

Family Lophospiridae

Subfamily Ruedemanniinae

Genus *Worthenia* de Koninck, 1883

Worthenia tabulata (Conrad, 1835)

Plate 10, figure 35

1835 *Turbo tabulatus* Conrad, p. 267, pl. 13, fig. 1.

1883 *Worthenia tabulata* de Koninck, p. 64.

Description: Turbinate gradate conch bearing nodes on raised selenizone.

Discussion: The only collected specimen is so poorly preserved that most of the ornament is not evident.

Distribution: Community 4: F-1WW-1

Suborder Trochina

Family Platyceratidae

Genus *Platyceras* Conrad, 1840

Subgenus *P*. (*Platyceras*) Conrad, 1840, p. 205

Platyceras (*Platyceras*) species

Plate 10, figure 6

Description: Unornamented capuliform conch with early growth coiled.

Distribution: Community 5: WA-3E-8

Subgenus *P*. (*Orthonychia*) Hall, 1843, p. 173

Platyceras (*Orthonychia*) species

Plate 10, figures 12, 13

Description: Unornamented, uncoiled capuliform conch.

Distribution: Community 4: WA-4E-17; Community 5: CH-3E-1, 30, WA-3E-16

Order Caenogastropoda

Family Subulitidae

Genus _Soleniscus_ Meek and Worthen, 1861, p. 467

Soleniscus species

Plate 10, figures 28, 29, 34

Description: Fusiform conch with small siphonal canal and lacking ornament.

Discussion: Figured specimens of _Soleniscus_ may actually belong to two different species.

Distribution: Community 4: F-2E-1, WA-4E-20

Genus _Ianthinopsis_ Meek and Worthen, 1866, p. 362

Ianthanopsis species

Plate 10, figure 27

Description: Ovoid with prominent sutures and no ornament.

Distribution: Community 4: WA-4E-2

Unidentified Gastropods

Description: Parts of whorls and internal molds.

Distribution: Community 2: F-1E-24, F-2E-3, 57; Community 4: F-1E-22; Community 5: CA-6EE-4

Class Cephalopoda

Subclass Nautiloidea

Order Orthocerida

Superfamily Pseudorthocerataceae

Family Pseudorthoceratidae

Subfamily Pseudorthoceratinae

Genus *Pseudorthoceras* Girty, 1911

* *Pseudorthoceras stonense* Gordon, 1964, p. 111

Plate 12, figures 1, 2

Description: Circular to slightly depressed conch, rate of expansion in width vs. length, 1:8. Camerae with thick deposits; 1.9 camerae per diameter unit length. Cyrtochoanitic siphuncle.

Discussion: In the one specimen collected the adoral camerae are crushed and the apex is not preserved.

Distribution: Community 2: F-2E-3

Pseudorthoceras? species

Plate 12, figure 3

Description: Circular to slightly depressed conch with slightly curved septa.

Discussion: This poorly preserved specimen shows very little internal detail and is unornamented. It probably belongs in *Pseudorthoceras*.

Distribution: Community 4: F-2E-2

Subfamily Spyroceratinae

Genus *Mitorthoceras* Gordon, 1960

Mitorthoceras crebriliratum (Girty, 1909)

Plate 12, figures 4, 5

1909 *Orthoceras crebriliratum* Girty, p. 46, pl. 6, figs. 9, 9a, 10.

* 1960 *Mitorthoceras crebriliratum* (Girty) Gordon, p. 136.

Description: Conch surface ornamented by slightly sinuous lirae, approximately 9 lirae per millimeter length. Cyrtochoanitic siphuncle and deeply curved septa.

Discussion: The illustrated specimen is a small fragment, but another specimen from F-1E-1 is approximately 6 cm long with a maximum width of approximately 1.75 cm and is an external mold in a siderite nodule.

Distribution: Community 2: F-2E-3; Undetermined community: F-1E-1

Unidentified Uncoiled Nautiloids

Description: Fragments of "orthocerid" nautiloids without preserved internal structures.

Distribution: Community 2: F-2E-3; Community 4: WA-4E-2

Order Nautilida

Superfamily Tainocerataceae

Family Tainoceratidae

Genus *Tylonautilus* Pringle and Jackson, 1928

Tylonautilus nodosocarinatus (Roemer, 1863)

Plate 12, figures 8, 9, 12, 13, 15, 17, 18

1863 Nautilus nodoso-carinatus Roemer, pp. 577-578, pl. 14, figs. 8a-c.

1928 Tylonautilus nodosocarinatus (Roemer) Pringle & Jackson, p. 374.

Description: Conch evolute with subquadrate whorl section and perforate umbilicus. Ornament consists of narrow, smooth ventral sulcus flanked by 3 lirae on each side and 6 flank and umbilical lirae, two of which pass over single row of nodes on flank.

Discussion: This genus has been reported by Miller and Furnish (1955) to be characteristic of the E_1 zone of the Upper Carboniferous (Middle Chester of U. S. nomenclature).

Distribution: Community 2: F-2E-3; Community 4: WA-4E-2

Superfamily Trigonocerataceae

Family Trigonoceratidae

Genus Stroboceras Hyatt, 1884

Stroboceras sulcatum (Sowerby)

Plate 12, figures 10, 16

* 1827 Nautilus sulcatus Sowerby, p. 137, pl. 571, figs. 1, 2.

1893 Stroboceras sulcatum (Sowerby) Hyatt, p. 411.

Description: Compressed, discoidal, evolute conch with slight ventral sulcus and ridges and grooves on flanks.

Discussion: All specimens collected are silicified.

Distribution: Community 4: WA-4E-2, CA-6EE-4

Family Centroceratidae

Genus Diorugoceras Hyatt, 1893, p. 416

Diorugoceras? species

Plate 12, figures 11, 14

Description: Compressed, discoidal, strongly involute conch with small umbilicus. Venter slightly convex with angular shoulders.

Discussion: The only collected specimen is tentatively assigned to this genus because of the external features. The ventral and dorsal lobes of the suture are unknown, but the lateral lobe is deep and broad (Kummel, 1964, p. K432). This specimen shows a sharply lobed ventral suture. Kummel (ibid) has reported Diorugoceras only from the Lower Carboniferous of Europe.

Distribution: Community 4: WA-4E-2

Superfamily Clydonautilaceae

Family Liroceratidae

Genus Bistrialites Turner, 1954

Bistrialites? species

Plate 12, figures 6, 7

Description: Fairly involute, globose, with reniform whorl section. Ornament consists of a few lirae on the umbilical shoulders.

Discussion: The only specimen collected is tentatively assigned to this genus based on external features. Kummel

(1964), p. K446) reported the genus only from the Lower Carboniferous of Europe.

Distribution: Community 4: WA-4E-2

Subclass Ammonoidea

Order Goniatitida

Family Goniatitidae

Subfamily Goniatitinae

Genus Goniatites de Haan, 1825

Goniatites aff G. granosus Portlock, 1843, p. 407

Plate 13, figures 12, 13

Description: Subglobose, finely lirate conch. Involute with small umbilicus and bearing constrictions.

Discussion: The suture is poorly preserved on the illustrated specimen, but generally resembles Goniatites. The small number of lirae (approximately 70 to 80 estimated) suggests that the species is G. granosus. Granules on lirae are not apparent due to poor preservation.

Distribution: Community 4: WA-4E-2

Genus Cravenoceras Bisat, 1928, p. 132

Cravenoceras species

Plate 13, figures 8, 9

Description: Globose conch ornamented by flat, transverse ribs.

Discussion: All specimens of Cravenoceras are crushed perpendicular to the plane of bilateral symmetry, and such diagnostic features as sutures and umbilici are not preserved. Identification is based solely on external ornament.

Distribution: Community 1: F-2E-13, F-1W-23; Unidentified community: F-1W-46, F-2E-4

Subfamily Neoglyphioceratinae

Genus Lyrogoniatites Miller and Furnish, 1940

* Lyrogoniatites newsomi georgiensis Miller & Furnish, 1940, p. 368

Plate 13, figures 14, 16-19, Plate 16, figure 1

Description: Fairly involute, globose to subglobose conch with a small umbilicus, and numerous longitudinal and transverse lirae.

Discussion: Miller and Furnish's types were from the Floyd Shale of Floyd County. The most common preservation of this species is in siderite nodules.

Distribution: Community 2: F-1E-24, 26, F-2E-3, 55; Unidentified community: F-1E-1, 45, PW-3

Genus Neoglyphioceras Brüning, 1923

Neoglyphioceras subcirculare (Miller, 1889)

Plate 13, figures 3-5

1889 Goniatites subcircularis Miller, p. 440, text fig. 741.

1937 Neoglyphioceras subcirculare (Miller) Plummer & Scott, p. 186.

Description: Discoidal involute conch, with approximately 34 longitudinal lirae; umbilicus very small.

Discussion: Specimens were identified solely on the basis of external appearance.

Distribution: Community 2: F-1E-46; Community 4: F-1E-22

Subfamily Girtyoceratinae

Genus *Girtyoceras* Wedekind, 1918, p. 140

Girtyoceras? species

Plate 13, figures 1, 2

Description: Subdiscoidal, somewhat involute conch with fairly large umbilicus (about 1/3 total diameter); ornament of growth constrictions that form a saddle on the venter.

Discussion: The only specimen collected is preserved on only one side, and the sutures are not preserved.

Distribution: Community 4: CH-3E-2

Unidentified Ammonoids

Description: Fragments of what are probably ammonoid shells.

Distribution: Community 1: F-1W-33; Community 2: F-1E-38; Unidentified Community: F-1E-43, F-2E-30, G-3EE-2

Class Bivalvia

Subclass Palaeotaxodonta

Order Nuculoida

Superfamily Ctenodontacea

Family Ctenodontidae

Genus *Clinopistha* Meek and Worthen, 1870, p. 44

Clinopistha species

Plate 11, figures 5, 10, 14

Description: Small, anteriorly elongate, strongly inflated shells with taxodont dentition. Ornament of fine, concentric growth lines.

Distribution: Community 2: F-2E-3

Superfamily Nuculacea

Family Nuculidae

Genus *Nuculopsis* Girty, 1911, p. 133

Nuculopsis species

Plate 11, figures 4, 6, 9, 11

Description: Small, anteriorly elongate, strongly inflated shells. Ornament of fine, concentric growth lines. Valves slightly geniculate with prominent umbo.

Discussion: Specimens assigned to this species closely resemble illustrations of *Nuculavus minuta* Chernyshev figured in McAlester (1968, pl. 12, figs. 1-9), but McAlester (1969, p. N231) included *Nuculavus* as a synonym of *Nuculopsis*.

Distribution: Community 2: F-1E-26, F-2E-55

Superfamily Nuculanacea

Family Nuculanidae

Genus *Phestia* Chernyshev, 1951, p. 9

Phestia species

Plate 11, figures 1-3, Plate 7, figure 23

Description: Small, posteriorly elongate, moderately inflated shells with taxodont dentition. Ornament of fine, concentric ridges.

Discussion: The material at hand appears to suggest two species of *Phestia* present in the Floyd Shale, but preservation precludes more detailed study.

Distribution: Community 2: F-1E-26, 46, F-1W-1, F-2E-55, F-2EE-13; Community 3: F-2W-2; Community 4: F-1W-2

Subclass Pteriomorphia

Order Pterioida

Superfamily Pteriacea

Family Pterineidae

Genus *Caneyella* Girty, 1909

Caneyella? species

Plate 11, figure 17

Description: Elongate oval, slightly convex valves with fine ridges crossing forming a reticulate pattern.

Discussion: The only specimen collected is the external mold of part of one valve, but is not complete enough to definitely identify it as *Caneyella*. The ornament, slight inflation, and trend of the ribs suggest this genus.

Distribution: Community 3: F-2E-12

Superfamily Pectinacea

Family Aviculopectinidae

Subfamily Aviculopecteninae

Genus *Aviculopecten* M'Coy, 1851, p. 171

Aviculopecten species

Plate 11, figures 20, 21

Description: Suboval auriculate, slightly inflated shells. Ornament of radiating ribs. Posterior auricle at least as long as anterior.

Discussion: The specimen in figure 20 is certainly an *Aviculopecten*, and that in figure 21 generally appears to be one.

Distribution: Community 2: F-0E-1, F-1E-12, F-2E-3, 25, 57, G-2EE-14; Community 4: F-2E-2, WA-4E-20

Subfamily Streblochondriinae

Genus *Streblopteria* M'Coy, 1851, p. 170

Streblopteria species

Plate 11, figure 19

Description: Subcircular, auriculate shells with poorly defined posterior auricle. No ornament, posterodorsal angle obtuse.

Distribution: Community 4: WA-4E-23

Subclass Paleoheterodonta

Order Trigonioida

Superfamily Trigoniacea

Family Myophoriidae

Genus *Schizodus* de Verneuil & Murchison, 1844, p. 505

Schizodus species

Plate 11, figure 7

Description: Trigonally ovate, slightly inflated, subequilateral shells lacking ornament.

<u>Discussion</u>: The dentition is very poorly preserved on the specimen at hand, but suggests <u>Schizodus</u>.

<u>Distribution</u>: Community 4: WA-4E-2; Community 5: CA-6EE-4

Subclass Heterodonta

Order Veneroida

Superfamily Carditacea

Family Permophoridae

Subfamily Permophorinae

Genus <u>Permophorus</u> Chavan, 1954, p. 200

<u>Permophorus</u> species

Plate 11, figures 15, 16, 18

<u>Description</u>: Subrectangular shells with subrounded or rounded anterior and truncated posterior. Beak low, ornament consists of concentric grooves, may have oblique radiating ridge directed posteriorly.

<u>Distribution</u>: Community 2: F-2E-55; Community 4: F-1W-2, F-2E-2

Superfamily Crassatellacea

Family Crassatellidae

Subfamily Crassatellinae

Genus <u>Cypricardella</u> Hall, 1858

<u>Cypricardella</u> species

Plate 11, figure 8

<u>Description</u>: Subrectangular to subtrapezohedral, flattened shells. Ornament of rounded concentric ribs.

Discussion: The dentition is very poorly preserved on the collected specimens, but external characteristics suggest *Cypricardella*.

Distribution: Community 4: WA-4E-20

Subclass Anomalodesmata

Order Pholadomyoida

Superfamily Edomondiacea

Family Edmondiidae

Genus *Edmondia* de Koninck, 1841, p. 66

Edmondia species

Plate 11, figure 13

Description: Rounded subrectangular to ovate, inflated shells, with slightly incurved beak. Ornament of fine, concentric growth lines.

Distribution: Community 4: WA-4E-20

Superfamily Pholadomyacea

Family Pholadomyidae

Genus *Wilkingia* Wilson, 1959, p. 401

Wilkingia species

Plate 11, figure 12

Description: Elongate oval shells with beaks close to front margin. Ornament of broad, concentric, rounded ridges.

Distribution: Community 2: F-2E-55

Unidentified Bivalves

Description: Fragments or molds of bivalve shells.

Distribution: Community 2: F-1E-26, 46; Community 4: WA-4E-2

Phylum Arthropoda

Subphylum Trilobitomorpha

Class Trilobita

Order Ptychopariida

Family Phillipsiidae

Genus *Kaskia* Weller, 1936, p. 708

Kaskia species

Plate 13, figures 10, 11, 15

Description: Glabella expanded anteriorly with little or no anterior brim, no preoccipital lobe, large eyes. Pygidium with trapezoidal axial cross section with 13 x 17 axial segments and 8 to 12 pleural segments.

Discussion: Several parts of cephalons and a few pygidia are quite similar to Weller's description.

Distribution: Community 2: F-2E-3

Unidentified Trilobita

Plate 13, figures 6, 7

Description: Parts of thoraxes of two unidentified trilobites.

Distribution: Community 2: F-1E-9; Community 3: F-2E-12

Phylum Echinodermata

Subphylum Blastozoa

Class Blastoidea

Order Fissiculata

Family Phaenoschismatidae

* Genus Hadroblastus Fay, 1962, p. 189

Hadroblastus species

Plate 15, figures 38, 39

Description: Relatively low, biconvex theca with subequal vault and pelvis. Ambulacral areas broad, bearing long respiratory slits. Thecal plates thin, commonly with prominent growth lines.

Discussion: Floyd Shale Hadroblastus are commonly badly crushed, and no specific assignment has been hazarded. Breimer and Macurda (1972, pp. 290-294, text fig. 100) summarized the geographic and stratigraphic distribution of fissiculate blastoid genera. In North America, no Mississippian fissiculates have been reported from rocks younger than the Osage series, and Hadroblastus has only been reported from rocks of Early Mississippian age. The single Hadroblastus collected at locality CH-3E-30 occurs in a fauna that includes both Late Meramecan and Early Chesteran fossils. Three specimens of Hadroblastus collected at locality F-2E-3 occur in a fauna that is certainly Middle Chesteran (lowermost Namurian of European terminology). These occurrences considerably extend the known stratigraphic range of this genus.

Distribution: Community 2: F-2E-3; Community 5: CH-3E-30

Order Spiraculata

Family Pentremitidae

Genus *Pentremites* Say, 1820, p. 36

Plate 15, figures 27, 31-34, 37

Description: Theca high dome-shaped to truncated biconical. At summit, central mouth surrounded by four spiracles and enlarged anispiracle. Anal deltoid undivided. Broad ambulacra with single pores between side plates along ambulacral margins. Radials overlap deltoids externally.

Discussion: Broadhead (1974) reported that biometric studies of Floyd Shale *Pentremites* showed two broadly defined species: *P. godoni* (DeFrance) and *P. pyriformis* Say. He believed that populations of *Pentremites* in the Floyd Shale showed a range of variation through geographic and stratigraphic distance, and that they were probably not useful for specific correlation.

Distribution: Community 4: F-1W-2, 35, F-1WW-1, 4, F-2E-1, 2, 17, F-2W-1, 3, CH-2E-18, 23, CH-2W-2, 19, WA-4E-2, 5, 9, 17, 20, 21, 23, 24, WH-5EE-3, CA-6EE-3, 5; Community 5: CH-2W-10, CH-3E-1, 3, 28, 20, WA-3E-8, 9, WA-4E-22, CA-6EE-4, 16, 19

Subphylum Crinozoa

Class Crinoidea

Subclass Camerata

Order Monobathrida

Family Dichocrinidae

Subfamily Dichocrininae

Genus Dichocrinus Münster, 1839

* Dichocrinus aff. D. huntsvillae Wachsmuth & Springer, 1897, p. 773

Plate 15, figures 1, 2, 6, 7

Description: Small dorsal cup with low, upward flairing basals. Plates unornamented: BB two, RR five, equal. Anal plate narrower at top than radials, wider at base.

Discussion: This species was reported originally from the Meramecan of Alabama. Description of the dorsal cup suggests this identification for Floyd Shale specimens.

Distribution: Community 5: CH-3E-30

Subfamily Talarocrininae

Genus Talarocrinus Wachsmuth & Springer, 1881

Talarocrinus aff. T. symmetricus Casseday & Lyon, 1860, p. 21

Plate 15, figures 3, 8, 12, 13

Description: Dorsal cup very low, bowl-shaped, slightly lobed with conical to globose ventral disc. BB two, RR five, anal plate slightly longer than RR.

Discussion: Floyd Shale specimens with a very low dorsal cup are included in this species.

Distribution: Community 4: F-1W-2; Community 5: CH-3E-3, CA-6EE-4

Talarocrinus cf. *T. ovatus* Worthen, 1882, p. 36

Plate 15, figures 4, 5, 9-11

Description: Calyx elongate, suboval. Dorsal cup elongate, slightly flaired outward. BB two, RR elongate five, anal plate elongate, slightly higher than RR.

Discussion: Specimens from the Floyd Shale with high dorsal cups have been assigned to this species.

Distribution: Community 5: CH-3E-30

Subclass Flexibilia

Order Sagenocrinida

Family Sagenocrinitidae

Genus *Forbesiocrinus* de Koninck & LeHon, 1854, p. 118

Forbesiocrinus species

Plate 14, figures 7, 8

Description: Large crinoids with loosely sutured plates. iBr strongly inflated.

Discussion: Identification is based on illustrations and comment on species of this genus in Springer (1920).

Distribution: Community 4: CH-2E-17

Order unknown

Unidentified flexible crinoids

Plate 14, figures 1-3, 6

Description: Proximal stems with fused iBB (figs. 1, 6) and isolated arm plates (figs. 2, 3) belonging to flexible crinoids.

Distribution: Community 4: F-2E-1, 2, 17, CH-2W-19, WA-3E-15, WA-4E-8, CA-6EE-14; Community 5: CH-3E-1

Subclass Inadunata

Order Cladida

Superfamily Scytalocrinacea

Family Aphelecrinidae

Genus *Aphelecrinus* Kirk, 1944

Aphelecrinus bayensis (Meek and Worthen, 1865)

Plate 14, figures 31, 32

1865 *Poteriocrinus* (*Scaphiocrinus*) *bayensis* Meek & Worthen, p. 157.

* 1944 *Aphelecrinus bayensis* (Meek & Worthen) Kirk, p. 192.

Description: Medium to large crinoids with turbinate to conical dorsal cup. Infrabasals visible from the side. Arms bifurcate at first IBr only. Arms uniserial tending toward biserial, pinnulate.

Discussion: The specimen illustrated in Plate 14, figure 32 is aberrant, with the left arm of the LPR bifurcating at the sixth IIBr.

Distribution: Community 4: F-2E-1

Aphelecrinus popensis (Worthen, 1882)

Plate 14, figure 26

1882 Poteriocrinus popensis Worthen, p. 23.

1886 Scaphiocrinus popensis (Worthen) Wachsmuth & Springer, p. 160.

* 1943 Pachylocrinus popensis (Worthen) Bassler & Moody, p. 583.

* 1971 Aphelecrinus popensis (Worthen) Burdick & Strimple, p. 38.

Description: Small crinoids with low, conical dorsal cup and infrabasals visible from side. Arms bifurcate above first IBr and again at about the seventh to ninth IIBr. Branching appears to be endotomous, arm ossicles slightly cuneate.

Distribution: Community 4: F-2E-1

Aphelecrinus randolphensis (Worthen, 1873)

Plate 14, figure 33

1873 Poteriocrinus (Scaphiocrinus) randolphensis Worthen, p. 551, pl. 21, fig. 14.

* 1944 Aphelecrinus randolphensis (Worthen) Kirk, p. 200.

Description: Low conical dorsal cup with small iB visible from the side. Arms endotomous, branching at first IBr. Second and third order branchings present. Arm ossicles cuneate.

Distribution: Community 4: F-2E-1

Aphelecrinus species

Plate 14, figures 27, 28

Description: One small individual and part of the anal sac of a large specimen probably belong in *Aphelecrinus*.

Distribution: Community 4: F-2E-1

Family Blothrocrinidae

Genus *Ulrichicrinus* Springer, 1926

* *Ulrichicrinus chesterensis* Strimple, 1949, p. 29

Plate 14, figures 24, 29, 30

Description: High bowl-shaped to turbinate dorsal cup with erect iBB. Ornament on plates of fine concentric rings. All arms branch at first IBr. Arms in all but AR may branch again at first IIBr.

Discussion: Strimple (1949, p. 29) suggested that the number of arms is variable, but that the species normally has 13. The figured specimen from the Floyd Shale has 15 arms.

Distribution: Community 4: F-2E-1, 2

Superfamily Agassizocrinacea

Family Agassizocrinidae

Genus *Agassizocrinus* Owen & Shumard, 1851

Agassizocrinus cf. *A. conicus* Owen & Shumard, 1851, p. 93

Plate 14, figures 18, 21

Description: Elongate fused infrabasal circlet.

Discussion: Horowitz (1965, p. 38) suggested that only this species and *A. lobatus* Springer may be identified solely on the basis of infrabasal circlets.

Distribution: Community 5: CA-6EE-7, WA-4E-22

Agassizocrinus species

Plate 14, figures 9-11, 16, 17, 19, 20

Description: Low, bowl-shaped fused infrabasal circlets that may have a central basal concavity (fig. 9). Thick, polygonal basal or anal plates (fig. 11). Thick, low, radial plates (fig. 10).

Distribution: Community 2: F-2E-3; Community 4: F-1W-2, F-1E-2, CH-2W-2, WA-4E-2, CA-6EE-3, 14; Community 5: CH-2W-10, WA-3E-1, WA-4E-22, CA-6EE-2, 4, 7

Superfamily Cromyocrinacae

Family Phanocrinidae

Genus *Phanocrinus* Kirk, 1937

* *Phanocrinus alexanderi* Strimple, 1948, p. 493

Plate 14, figure 13

Description: Very low, bowl-shaped cup constricted above radials. Arms relatively short, stout, bifurcating only at first IBr. Arm plates short, wide rectangular. Arms tapering only near distal ends.

Discussion: The low, bowl-shaped cup and shorter arms distinguish this species from *P. formosus* (Worthen) in Floyd Shale samples.

Distribution: Community 4: F-2E-1

Phanocrinus formosus (Worthen)

Plate 14, figures 4, 5

* 1873 Poteriocrinites (Zeacrinus) formosus Worthen, p. 549, pl. 21, fig. 2.

* 1937 Phanocrinus formosus (Worthen) Kirk, p. 603, pl. 84, figs. 1, 2.

Description: Bowl-shaped dorsal cup with flat base. Arms bifurcate only at first IBr, rather long, uniserial. Three anal plates in cup. iBB not visible from side, but extending beyond stem attachment scar.

Discussion: This is one of the most common crinoid species in the Floyd Shale.

Distribution: Community 2: F-2E-3, Community 4: CH-2E-17, F-2E-1, 2, F-1WW-1, F-2W-3

Genus Pentaramicrinus Sutton & Winkler, 1940

Pentaramicrinus fragosus (Sutton & Winkler, 1940)

Plate 14, figure 12

* 1940 Phanocrinus fragosus Sutton & Winkler, p. 557, pl. 67, figs. 5, 6.

* 1969 Pentaramicrinus fragosus (Sutton & Winkler) Burdick & Strimple, p. 9.

Description: Bowl-shaped dorsal cup with unflaired RR. Arms bifurcate only at first IBr, which is somewhat elongate. Arms uniserial with slightly cuneate ossicles.

Discussion: The shape of the dorsal cup distinguishes this species from species of Phanocrinus from the Floyd Shale.

Distribution: Community 4: F-2E-1

Superfamily Zeacrinitacea

Family Zeacrinitidae

Genus Zeacrinites Troost, 1858

Zeacrinites doverensis Miller & Gurley, 1896, p. 35

Plate 14, figure 23

Description: Very low, bowl-shaped cup with prominent anal series consisting of 7 plates. Anterior ray bifurcates above third IBr. Basal cavity deep.

Discussion: Horowitz (1965, pp. 14-16) summarized species of Zeacrinites from the Glen Dean Limestone. This specimen corresponds very closely to those described for Z. doverensis.

Distribution: Community 4: F-1WW-1

Zeacrinites species

Plate 14, figures 14, 15

Description: Very low dorsal cup with prominent basal cavity containing very small iBB. BB small, narrow. RR outflaired.

Discussion: The lack of arms and complete anal series precludes specific assignment of these specimens.

Distribution: Community 4: F-1WW-1, F-2E-1; Community 5: CH-3E-28

Genus Linocrinus Kirk, 1938, p. 168

Plate 14, figure 22

Description: Cup as in Zeacrinites, but plates strongly rugose. Arms rugose, commonly incurved.

Discussion: Poor preservation of the anal series precludes specific identification.

Distribution: Community 4: F-2E-1

Genus Tholocrinus Kirk, 1939

Tholocrinus wetherbyi (Wachsmuth & Springer, 1886)

Plate 14, figure 25

1886 Hydreionocrinus wetherbyi Wachsmuth & Springer, p. 245.

* 1939 Tholocrinus wetherbyi (Wachsmuth & Springer) Kirk, p. 471.

Description: Dorsal cup similar to that of Zeacrinites, but may be slightly rugose. Arms dividing three times, each Ax bearing a prominent spine.

Discussion: The large anal sac is not exposed in any of the collected specimens.

Distribution: Community 4: F-2E-1

Unidentified inadunates

Description: Isolated plates and fragments of dorsal cups belonging to various inadunate genera.

Distribution: Community 4: F-1WW-1, 4, F-2E-1, 17, F-2W-1,

CH-2W-2, CH-3E-7, WA-4E-2, 17, 25, WH-5EE-3; Community 5: CH-3E-1, WA-4E-22, CA-6EE-2, 7; Unidentified community: CA-6EE-1

Subclass and Order uncertain

(Columnals)

Group Cyclici

Family Cyclomischidae

Genus Stiberostaurus Moore & Jeffords, 1968

Stiberostaurus aestimatus Moore & Jeffords, 1968

Plate 15, figures 17, 24

1968 Stiberostaurus aestimatus Moore & Jeffords, p. 61.

Description: Homeomorphic stem with noditaxes composed of four columnals. Columnals with angular equatorial rim, sutures in flatly rounded depressions. Broad crenularium surrounds large, circular lumen.

Discussion: Moore and Jeffords assigned an age of Early Mississippian to this genus and species, but specimens from the Floyd Shale are of undoubted Chesteran age.

Distribution: Community 4: CA-6EE-3; Community 5: CA-6EE-19

Family unknown

Stem A

Plate 15, figure 14

Description: Small, upward flairing homeomorphic column.

Columnals with angular equatorial rim, sutures in angular depressions. Lumen indistinct.

Discussion: This column type probably is the proximal part of a xenomorphic stem, perhaps that of a flexible crinoid.

Distribution: Community 4: F-2E-1, 2

Stem B

Plate 15, figures 15, 16, 21

Description: Small, heteromorphic columns with four columnals per repeat group. Moderately large crenularium surrounds circular lumen.

Distribution: Community 2: F-2E-3; Community 4: F-2W-1, 3, CH-2W-2, 19; Community 5: CH-3E-28

Stem C

Plate 15, figures 18, 26, 29

Description: Homeomorphic to heteromorphic columns with two columnals per repeat group. Small to moderately large crenularium surrounds five-petal lumen. Columnals smooth, may be slightly indented at sutures.

Distribution: Community 4: F-1WW-1, 4, F-2E-1, 2, 17, F-2W-1, 3, F-3EE-3, WA-3E-15, WA-4E-2, 8, 9, 17, 21, 23, 24, 25, CA-6EE-3, 11; Community 5: CH-3E-1, 3, WA-3E-1, 8, 9, 16, WA-4E-22, CA-6EE-2, 4, 19

Stem D

Plate 15, figures 19, 20

Description: Homeomorphic columns that may have abundant, scattered noditaxes. Large crenularium surrounds small, circular lumen. Columnals smooth, may be slightly indented at sutures.

Distribution: Community 2: F-1E-2, 16, F-1W-16, F-2E-3, 57, F-2EE-20, G-2EE-14, CH-2E-19, 22, CH-3E-25; Community 3: F-2E-12, CA-6EE-13; Community 4: F-1W-2, 35, F-1WW-1, 3, 4, F-2E-1, 2, 17, 22, F-3EE-3, 4, CH-2E-4, 17, 18, CH-2W-9, 19, CH-3E-2, 4, 7, WA-3E-11, 12, WA-4E-2, 5, 8, 9, 17, 18, 20, 21, 24, WH-5EE-3, CA-6EE-3, 5, 11, 14, 18; Community 5: CH-2E-20, CH-2W-10, CH-3E-1, 28, 30, WA-3E-1, 8, 9, 16, WA-4E-11, 22, CA-6EE-2, 4, 7, 10, 16, 19; Unidentified community: F-2EE-9, F-2E-9, WA-3E-6, 13, CA-6EE-1

Stem E

Plate 15, figures 22, 23

Description: Heteromorphic column with two columnals per repeat group. Columnal rims commonly lobed, indented toward sutures. Narrow crenularium surrounds areola containing narrow, five-petal lumen.

Distribution: Community 4: F-2E-1, 2, F-2W-1, 3, F-3EE-3, CH-2E-17, CH-2W-9, WA-4E-9; Community 5: CA-6EE-7

Subphylum Echinozoa

Class Echinoidea

Order Cidaroida

Family Archaeocidaridae

Genus Archaeocidaris M'Coy, 1844, p. 173

Plate 15, figures 25, 28, 30, 35, 36

Description: Interambulacral plates of moderately large cidaroid echinoids with perforate, noncrenulate primary tubercles and marginal scrobicular ring. Spines unornamented.

Distribution: Community 4: F-1E-14, F-1WW-1, F-2E-17, F-3EE-3, 4, CH-2W-2, 9, WA-4E-9, 23; Community 5: CH-2W-10, CH-3E-28, WA-3E-8

Kingdom Plantae

Division Lycophyta

Class Lycopsida

Order Protolepidodendrales

Family Archaeosigillariaceae

Genus Archaeosigillaria Kidston, 1901

Archaeosigillaria species?

Plate 16, figure 9

Description: Small axes bearing alternating rows of subhexagonal leaf attachment scars. No vertical bands.

Discussion: Theodore Delevoryas (personal communication, 1973) has suggested that the carbonized stems preserved in argillaceous limestone at locality # CA-6EE-3 may represent axes of Archaeosigillaria. The specimens collected do not show evidence of leaf attachment scars.

Distribution: Community 4: CA-6EE-3

Order Lepidodendrales

Family Lepidodendraceae

Genus Lepidodendron Sternberg, 1820

Lepidodendron cf. L. volkmannianum Sternberg, 1825, p. 10

Plate 16, figures 1, 2, 3, 4, 6, 8

Description: Axes bearing very elongate diamond-shaped leaf attachment scars, helically arranged.

Distribution: Community 2: F-1E-26; Unidentified community: F-1E-1

Genus *Lepidophloios* Sternberg, 1825, p. 13

Lepidophloios species

Plate 16, figure 5

Description: Axes bearing transversely elongate, imbricate leaf attachment scars arranged helically.

Distribution: Community 1: F-2E-13

Division Sphenophyta

Class Sphenopsida

Order Equisetales

Family Archaeocalamitaceae

Genus *Archaeocalamites* Stur, 1875, p. 2

Archaeocalamites species

Plate 16, figure 7

Description: Internal impressions of the pith cavity showing the internodal and nodal outline of vascular rays. Rays not alternating at nodes.

Discussion: The only collected specimen is a fortuitous fragment showing part of a node.

Distribution: Unidentified Community: F-1E-43

Division and Class unknown

Unidentified plant remains

Plate 16, figure 10

Description: Fragments of stems and ?leaves preserved as carbonized films in shale and siltstone.

Distribution: Community 1: F-2E-13, F-3EE-1; Community 2: F-1E-12, 38, F-1W-53, F-2E-55, 57; Unidentified community: F-2E-4

APPENDIX A

LOCALITY DESCRIPTIONS

Locality descriptions include only those of fossiliferous localities. Data presented include locality number (for explanation, see Methods and fig. 1), coordinates of the locality, lithic type, fossils present (listed in the order presented in Systematic Paleontology), and community designation.

P-W-3 - 34°2'20"N 85°21'47"W - Black to greenish black shale and phyllite containing siderite nodules - Lyrogoniatites newsomi georgiensis: Unidentified community.

F-0E-1 - 34°14'48"N 85°13'38"W - Light brown, deeply weathered siliceous limestone - Orbiculoidea sp., Inflatia inflata, Composita sp., Spirifer sp., Reticulariina spinosa, Aviculopecten sp.: Community 2.

F-1E-1 - 34°16'45"N 85°13'19"W - Brown shale containing siderite nodules - ?Pugnoides ottumwa, Composita sp., Mitorthoceras cf. M. crebriliratum, Lyrogoniatites newsomi georgiensis, Lepidodendron cf. L. volkmannianum: Unidentified community.

F-1E-2 - 34°17'20"N 85°12'18" W - Dark gray to gray fine to coarsely crystalline limestone containing minor shale beds - Fistulipora sp., Orthotetes kaskaskiensis, Flexaria arkansana, Ovatia ovata, unidentified rhynchonellid, Composita subquadrata, Spirifer leidyi, Reticulariina spinosa, Torynifer setigera, Agassizocrinus sp., Echinoderm stem D: Community 2.

F-1E-8 - 34°17'3"N 85°13'49"W - Gray limestone to argillaceous limestone - Spirifer arkansanus, unidentified productid, Glabrocingulum (Glabrocingulum) sp.: Community 2.

F-1E-9 - 34°16'59"N 85°14'28"W - Gray limestone to argillaceous limestone - Chonetes chesterensis, Inflatia inflata, Spirifer arkansanus, unidentified trilobite: Community 2.

F-1E-12 - 34°21'50"N 85°9'55"W - Gray limestone to argillaceous limestone - Fistulipora sp., "Fenestella" sp., Orbiculoidea sp., Chonetes chesterensis, Heteralosia sp., Inflatia inflata, unidentified rhynchonellid, Eumetria vera, Composita sp., Punctospirifer transversus, Torynifer setigera, Dielasma inflata, Aviculopecten sp., unidentified plant: Community 2.

F-1E-14 - 34°17'27"N 85°10'49"W - Red clay saprolite containing siliceous limestone - unidentified hapsiphyllid, Inflatia inflata, unidentified productid, Cleiothyridina sublamellosa, Archaeocidaris sp.: Community 4.

F-lE-16 - 34°17'52"N 85°10'36"W - Brown to light brown argillaceous and siliceous limestone - "*Fenestella*" sp., *Sulcoretepora* sp., *Inflatia inflata*, unidentified productid, Echinoderm stem D: Community 2.

F-lE-22 - 34°22'2"N 85°7'59"W - Red clay saprolite - *Amplexizaphrentis* sp., unidentified hapsiphyllid, *Syringopora* sp., *Fistulipora* sp., *Inflatia inflata*, *Eumetria vera*, *Spirifer leidyi*, *Torynifer setigera*, unidentifed gastropod, *Neoglyphioceras subcirculare*: Community 4.

F-lE-24 - 34°21'41"N 85°8'2"W - Gray to brown shale containing siderite nodules - *Leiorhynchoidea carboniferum*, *Spirifer* sp., *Punctospirifer transversus*, unidentified gastropod, *Lyrogoniatites newsomi georgiensis*: Community 2.

F-lE-26 - 34°21'22"N 85°9'49"W - Gray to dark gray shale containing siderite nodules - *Paraconularia* sp., *Oehlertella* sp., *Chonetes chesterensis*, *Flexaria arkansana*, unidentified rhynchonellid, *Composita* sp., *Spirifer leidyi*, *Rhineoderma* sp., *Trepospira* (*Angyomphalus*) sp., *Lyrogoniatites newsomi georgiensis*, *Nuculopsis* sp., *Phestia* sp., unidentified bivalve, *Lepidodendron volkmannianum*: Community 2.

F-lE-30 - 34°20'57"N 85°11'12"W - Gray to brown siltstone overlain by gray shale - *Lingula* cf. *L. carbonaria*:

Community 1.

F-1E-36 - 34°17'56"N 85°11'34"W - Red clay saprolite containing gray to white chert lenses - unidentified hapsiphyllid, *Heteralosia* sp., *Inflatia inflata*, *Ovatia ovata*, unidentified productid, *Cleiothyridina sublamellosa*, *Composita* sp., *Spirifer leidyi*, *Punctospirifer transversus*: Community 4.

F-1E-38 - 34°16'41"N 85°11'38" W - Gray to brown silty shale to siltstone - unidentified rhynchonellid, *Composita* sp., *Spirifer leidyi*, unidentified ammonoid, unidentified plant: Community 2.

F-1E-41 - 34°16'56"N 85°14'52"W - Dark gray to gray limestone to argillaceous limestone - *Chonetes chesterensis*, *Spirifer arkansanus*: Community 2.

F-1E-43 - 34°16'40"N 85°13'10"W - Gray to brown silty shale to siltstone - *Leiorhynchoidea carboniferum*, unidentified ammonoid, *Archaeocalamites* sp., unidentified plant: Unidentified community.

F-1E-44 - 34°16'23"N 85°13'28"W - Gray to brown silty shale to siltstone containing siderite nodules - unidentified ammonoid: Unidentified community.

F-1E-45 - 34°16'28"N 85°13'30"W - Brown soil containing siderite nodules - *Lyrogoniatites newsomi georgiensis*: Unidentified community.

F-1E-46 - 34°16'42"N 85°13'40"W - Dark gray to gray argillaceous limestone - Ovatia ovata, Composita sp., Neoglyphioceras cf. N. subcirculare, Phestia sp., unidentified bivalve: Community 2.

F-1W-1 - 34°22'29"N 85°16'58"W - Dark gray calcareous shale and siltstone - Chonetes chesterensis, unidentified rhynchonellid, Composita sp., Phestia sp.: Community 2.

F-1W-2 - 34°22'28"N 85°16'59"W - red clay saprolite - unidentified hapsiphyllid, Fistulipora sp., Lyropora sp., Crania sp., Protoniella parva, unidentified productid, Pugnoides ottumwa, Composita subquadrata, Spirifer sp., Reticulariina spinosa, Torynifer setigera, Girtyella indianensis, Dielasma sp., Bellerophon (Bellerophon) sp., Phestia sp., Permophorus sp., Pentremites sp., Talarocrinus cf. T. symmetricus, Agassizocrinus sp., Echinoderm stem D: Community 4.

F-1W-11 - 34°21'22"N 85°19'21"W - Gray to dark gray calcareous shale and siltstone - Lingula cf. L. carbonaria: Community 1.

F-1W-16 - 34°20'1"N 85°19'47"W - Brown clay containing sandstone fragments - Fenestella sp.; Flexaria arkansana, unidentified productid, Echinoderm stem D: Community 2.

F-1W-23 - 34°20'12"N 85°16'52"W - Gray shale to siltstone - Lingula cf. L. carbonaria, Composita sp., Cravenoceras sp.: Community 1.

F-1W-25 - 34°20'21"N 85°16'21"W - Dark gray shale to siltstone containing small amount of brown sandstone - unidentified brachiopod: Unidentified community.

F-1W-33 - 34°17'55"N 85°19'11"W - Gray to brown shale to siltstone - Lingula cf. L. carbonaria, unidentified ammonoid: Community 1.

F-1W-35 - 34°17'31"N 85°20'33"W - red clay saprolite - Cystelasma sp., Amplexizaphrentis spinulosus, unidentified hapsiphyllid, Michelinia sp., Fistulipora sp., Perditocardinia dubia, Brachythyris sp., Punctospirifer transversus, unidentified terebratulid, Pentremites sp., Echinoderm stem D: Community 4.

F-1W-46 - 34°16'41"N 85°16'47"W - Gray to brown shale to siltstone - Cravenoceras sp., unidentified plant: Unidentified community.

F-1W-53 - 34°17'5"N 85°15'5"W - Brown shale to sandstone - Paraconularia sp., unidentified productid, Leiorhynchoidea carboniferum, Spirifer sp., unidentified plant: Community 2.

F-1WW-1 - 34°31'22"N 85°27'7"W - reddish brown clay saprolite - unidentified hapsiphyllid, Striatopora sp., Fistulipora sp., "Fenestella" sp., Lyropora sp., Eumetria vera, Cleiothyridina sublamellosa, Composita subquadrata, Spirifer leidyi, Brachythyris sp., Reticulariina spinosa, Torynifer setigera, Girtyella indianensis, Dielasma sp., Worthenia tabulata, Pentremites sp., Phanocrinus formosus, Zeacrinites doverensis, Zeacrinites sp., unidentified inadunate, Echinoderm stems C, D, Archaeocidaris sp.: Community 4.

F-1WW-3 - 34°31'28"N 85°26'29"W - Light yellowish brown to reddish brown clay and silty saprolite containing siliceous limestone - unidentified hapsiphyllid, Lyropora sp., Perditocardinia dubia, Inflatia inflata, Cleiothyridina sublamellosa, Composita sp., Spirifer leidyi, Brachythyris sp., Echinoderm stem D: Community 4.

F-1WW-4 - 34°31'27"N 85°26'47"W - gray to brown calcareous shale - unidentified hapsiphyllid, Lyropora, Cleiothyridina sublamellosa, Spirifer leidyi, Brachythyris sp., Pentremites sp., unidentified inadunate, Echinoderm stems C, D: Community 4.

F-2EE-3 - 34°29'31"N 85°6'17"W - Gray to brown shale to siltstone - Lingula cf. L. carbonaria: Community 1.

F-2EE-9 - 34°26'21"N 85°6'9"W - Brown clay saprolite overlain by gray to brown sandstone - Echinoderm stem D: Unidentified community.

F-2EE-13 -34°26'12"N 85°6'59"W - Dark gray calcareous shale - Pugnoides ottumwa, Phestia sp.: Community 2.

F-2EE-19 -34°24'42"N 85°6'37"W -Gray to brown shale to silty shale - Lingula cf. L. carbonaria: Community 1.

F-2EE-20 -34°24'19"N 85°6'37"W - Gray to brown argillaceous limestone to calcareous shale - "Fenestella" sp., Orthotetes kaskaskiensis, Echinoderm stem D: Community 2.

F-2E-1 - 34°24'48"N 85°10'8"W - Gray to dark gray argillaceous limestone with brown clay saprolite - Paraconularia sp., Amplexizaphrentis spinulosus, unidentified hapsiphyllid, Fistulipora sp., "Fenestella" sp., Inflatia inflata, Echinoconchus biseriatus, Flexaria arkansana, Eumetria vera, Cleiothyridina sublamellosa, Composita sp. A, Spirifer leidyi, Brachythyris sp., Reticulariina spinosa, Dielasma sp., Bellerophon (Bellerophon) sp., Euconospira sp., Soleniscus sp., Pentremites sp., unidentified flexible, Aphelecrinus bayensis, A. popensis, A. randolphensis, A. sp., Phanocrinus alexanderi, P. formosus, Pentaramicrinus fragosus, Zeacrinites sp., Linocrinus sp., Tholocrinus wetherbyi, Ulrichicrinus chesterensis, unidentified inadunate, Echinoderm stems A, C, D, E: Community 4.

F-2E-2 - 34°24'26"N 85°10'4"W - Gray to dark gray argillaceous limestone with brown clay saprolite - Amplexizaphrentis spinulosus, unidentified hapsiphyllid, Fistulipora sp., "Fenestella" sp., Penniretepora sp., unidentified strophomenid, Inflatia inflata, Echinoconchus biseriatus, Ovatia ovata, unidentified productid, Eumetria vera, Cleiothyridina sublamellosa, Composita sp. A, Spirifer leidyi, Punctospirifer transversus, Reticulariina spinosa, Torynifer setigera, Dielasma sp., Rhineoderma piasaensis, Euconospira sp., ?Pseudorthoceras sp., Aviculopecten sp., Permophorus sp., Pentremites sp., unidentifed flexible, Phanocrinus formosus, Ulrichicrinus chesterensis, Echinoderm stems A, C, D, E: Community 4.

F-2E-3 - 34°27'47"N 85°8'53"W - Gray to brown calcareous shale to silty shale - Paraconularia sp., Fistulipora sp., "Fenestella" sp., Trigonoglossa? sp., Crania sp., Orbiculoidea sp., Chonetes chesterensis, Heteralosia sp., Inflatia inflata, Ovatia ovata, Eumetria costata, Cleiothyridina sublamellosa, Composita subquadrata, Crurithyris sp., Spirifer arkansanus, ?Dimegelasma sp., Punctospirifer transversus, Euphemites sp., Knightites (Retispira) bellireticulata, Rhineoderma sp., Trepospira (Angyomphalus) sp., Glabrocingulum (Glabrocingulum) sp., unidentified gastropod, Pseudorthoceras stonense, Mitorthoceras crebriliratum, unidentified nautiloid, Tylonautilus nodosocarinatus, Lyrogoniatites newsomi georgiensis, Clinopistha sp., Aviculopecten sp., Kaskia sp., Hadroblastus sp., Agassizocrinus sp., Phanocrinus formosus, Echinoderm stems B, D: Community 2.

F-2E-4 - 34°27'49"N 85°8'52"W - Gray to brown calcareous silty shale - Cravenoceras sp., unidentified plant: Unidentified community.

F-2E-9 - 34°25'7"N 85°12'54"W - Brown shale and siltstone - Echinoderm stem D: Unidentified community.

F-2E-11 - 34°24'4"N 85°13'30"W - Reddish brown clay and silt saprolite - Spirifer leidyi: Unidentified community.

F-2E-13 - 34°23'30"N 85°13'24"W - Interbedded light gray and black shale - Lingula cf. L. carbonaria, Cravenoceras sp., Lepidophloios sp., unidentified plant: Community 1.

F-2E-17 - 34°24'42"N 85°13'23"W - Brown to yellowish brown shale and siltstone - Amplexizaphrentis spinulosus, unidentified hapsiphyllid, Michelinia sp., Fistulipora sp., Schuchertella sp., Chonetes chesterensis, Echinoconchus alternatus, unidentified productid, Eumetria vera, Cleiothyridina sublamellosa, Composita subquadrata, Spirifer *leidyi*, *Brachythyris* sp., *Punctospirifer transversus*, *Reticulariina spinosa*, *Girtyella indianensis*, *Dielasma* sp., *Pentremites* sp., unidentified flexible, unidentified inadunate, Echinoderm stems C, D, *Archaeocidaris* sp.: Community 4.

F-2E-22 - 34°28'15"N 85°9'3"W - Red clay saprolite - unidentified hapsiphyllid, unidentified strophomenid, *Inflatia inflata*, *Echinoconchus alternatus*, unidentified productid, *Cleiothyridina sublamellosa*, *Composita* sp., *Spirifer leidyi*, *Dielasma* sp., Echinoderm stem D: Community 4.

F-2E-25 - 34°25'51"N 85°9'30"W - Gray calcareous shale - *Spirifer arkansanus*, *Aviculopecten* sp.: Community 2.

F-2E-28 - 34°26'45"N 85°9'12"W - Brown, red, and gray shale - "*Fenestella*" sp., unidentified productid, *Composita* sp., *Punctospirifer transversus*: Community 3.

F-2E-30 - 34°27'36"N 85°8'56"W - Brown to gray shale and sandy siltstone - unidentified ammonoid: Unidentified community.

F-2E-49 - 34°23'51"N 85°9'45"W - Gray, fine-grained limestone overlain by dark gray to brown shale with minor siltstone - "*Fenestella*" sp., unidentified brachiopod, Echinoderm stem D: Unidentified community.

F-2E-55 - 34°24'43"N 85°9'42"W - Dark gray to black shale - Orbiculoidea sp., unidentified strophomenid, Pugnoides ottumwa, unidentified rhynchonellid, Composita sp., Crurithyris sp., Trepospira (Angyomphalus) sp., Glabrocingulum (Glabrocingulum) sp., Lyrogoniatites newsomi georgiensis, Nuculopsis sp., Phestia sp., Permophorus sp., Wilkingia sp., unidentified plant: Community 2.

F-2E-57 - 34°24'45"N 85°9'32"W - Black and grayish purple shale overlain by gray argillaceous limestone - "Fenestella" sp., Chonetes chesterensis, Inflatia inflata, Spirifer arkansanus, unidentified gastropod, Aviculopecten sp., Echinoderm stem D, unidentified plant: Community 2.

F-2W-1 - 34°22'57"N 85°15'49"W - Red clay and silt saprolite - unidentified hapsiphyllid, Lyropora sp., Inflatia inflata, Echinoconchus alternatus, unidentified productid, Cleiothyridina sublamellosa, Composita sp., Spirifer leidyi, Spirifer sp., Brachythyris sp., Reticulariina spinosa, Girtyella indianensis, Pentremites sp., unidentified inadunate, Echinoderm stems B, C, D, E: Community 4.

F-2W-2 - 34°22'32"N 85°16'48"W - Brown shale and siltstone - "Fenestella" sp., Inflatia inflata, Phestia sp.: Community 3.

F-2W-3 - $34^{\circ}23'2''N$ $85^{\circ}15'48''W$ - Red clay saprolite - unidentified hapsiphyllid, Syringopora sp., Fistulipora sp., Eumetria vera, Cleiothyridina sublamellosa, unidentified athyrid, Spirifer leidyi, Reticulariina spinosa, Pentremites sp., Phanocrinus formosus, Echinoderm stems B, C, D, E: Community 4.

F-3EE-1 - $34^{\circ}33'21''N$ $85^{\circ}6'17''W$ - Light gray to white siltstone and sandy siltstone - Lingula cf. L. carbonaria, unidentified plant: Community 1.

F-3EE-3 - $34^{\circ}31'13''N$ $85^{\circ}7'7''W$ - Light brown siltstone overlain by red clay saprolite - unidentified hapsiphyllid, Michelinia sp., Fistulipora sp., Perditocardinia dubia, Inflatia inflata, unidentified productid, Composita sp., Spirifer sp., Brachythyris sp., Punctospirifer transversus, ?Dielasma sp., Echinoderm stems C, D, E, Archaeocidaris sp.: Community 4.

F-3EE-4 - $34^{\circ}30'56''N$ $85^{\circ}7'11''W$ - Red clay saprolite - unidentified hapsiphyllid, Eumetria vera, Cleiothyridina sublamellosa, Reticulariina spinosa, Echinoderm stem D, Archaeocidaris sp.: Community 4.

F-3EE-5 - $34^{\circ}30'35''N$ $85^{\circ}6'59''W$ - Light brown to yellow shale to siltstone - Lingula cf. L. carbonaria: Community 1.

G-2EE-1 - $34^{\circ}28'14"N$ $85^{\circ}4'58"W$ - Red clay saprolite and brown shale - "Fenestella" sp., Lingula cf. L. carbonaria, Ovatia ovata: Community 1.

G-2EE-14 -$34^{\circ}28'3"N$ $85^{\circ}4'43"W$ - Gray argillaceous limestone overlain by purplish red shale - Orthotetes kaskaskiensis, Chonetes chesterensis, Inflatia inflata, Ovatia ovata, Spirifer sp., Aviculopecten sp., Echinoderm stem D: Community 2.

G-3EE-2 - $34^{\circ}31'47"$ $85^{\circ}2'11"W$ - Gray to brown shale containing siderite nodules - unidentified ammonoid: Unidentified community.

CH-2E-4 - $34^{\circ}29'21"N$ $85^{\circ}13'54"W$ - Brown sandstone, siltstone, and shale - unidentified hapsiphyllid, "Fenestella" sp., Echinoderm stem D: Community 4.

CH-2E-14 -$34^{\circ}25'11"N$ $85^{\circ}14'31"W$ - Brown shale and siltstone - Lithostrotion proliferum, Echinoderm stem D: Unidentified community.

CH-2E-17 -$34^{\circ}28'44"N$ $85^{\circ}11'18"W$ - Red to brown clay saprolite - unidentified hapsiphyllid, Fistulipora sp., "Fenestella" sp., Schuchertella sp., Heteralosia sp., unidentified productid, Cleiothyridina sublamellosa, Composita sp., Spirifer leidyi, Punctospirifer transversus, Dielasma sp., Phanocrinus formosus, Echinoderm stems D, E: Community 4.

CH-2E-18 -$34^{\circ}28'37"N$ $85^{\circ}11'20"W$ - Red clay saprolite containing brown shale and sandstone chips -

Amplexizaphrentis spinulosus, unidentified hapsiphyllid, Michelinia sp., Fistulipora sp., Crania sp., Orbiculoidea sp., Schuchertella sp., Orthotetes kaskaskiensis, Inflatia inflata, Echinoconchus alternatus, unidentified productid, Eumetria costata, Cleiothyridina sublamellosa, Composita sp., unidentified athyrid, Crurithyris sp., Spirifer sp., Brachythyris sp., Punctospirifer transversus, Reticulariina spinosa, Girtyella indianensis, Bellerophon (Bellerophon) sp., Straparolus (Euomphalus) sp., Pentremites sp., Echinoderm stem D: Community 4.

CH-2E-19 - 34°26'45"N 85°14'52"W - Brown to red sandstone, siltstone, and shale - "Fenestella" sp., Archimedes sp., Polypora sp., unidentified productid, unidentified athyrid, Echinoderm stem D: Community 2.

CH-2E-20 - 34°26'9"N 85°14'56"W - Brown silty shale overlain by red clay saprolite containing siliceous limestone - unidentified hapsiphyllid, "Fenestella" sp., Archimedes sp., unidentified rhynchonellid, unidentified athyrid, unidentified ?terebratulid, Echinoderm stem D: Community 5.

CH-2E-21 - 34°25'50"N 85°14'58"W - Red clay saprolite - Archimedes sp., unidentified athyrid: Unidentified community.

CH-2E-22 - 34°25'30"N 85°14'54"W - Brown sandstone and silty shale to siltstone - "*Fenestella*" sp., *Archimedes* sp., *Punctospirifer transversus*, Echinoderm stem D: Community 2.

CH-2E-23 - 34°25'3"N 85°14'13"W - Silty shale overlain by red clay saprolite containing siliceous limestone - unidentified hapsiphyllid, "*Fenestella*" sp., *Archimedes* sp. unidentified productid, *Cleiothyridina sublamellosa*, *Composita* sp., unidentified athyrid, *Punctospirifer transversus*, *Reticulariina spinosa*, *Torynifer setigera*, *Pentremites* sp.: Community 4.

CH-2W-2 - 34°25'7"N 85°17'38"W - Red to brown clay saprolite - *Rotiphyllum* sp., *Zaphrentoides* sp., unidentified hapsiphyllid, *Michelinia* sp., *Palaeacis cuneiformis*, *Archimedes* sp., *Crania* sp., *Schuchertella* sp., *Chonetes chesterensis*, *Echinoconchus* sp., *Ovatia ovata*, unidentified productid, *Eumetria vera*, *Cleiothyridina sublamellosa*, *Composita* sp., *Spirifer leidyi*, *Brachythyris* sp., *Reticulariina spinosa*, *Torynifer setigera*, *Girtyella indianensis*, *Pentremites* sp., *Agassizocrinus* sp., unidentified inadunate, Echinoderm stems B, C, *Archaeocidaris* sp.: Community 4.

CH-2W-7 - 34°24'14"N 85°16'56"W - Orange brown to red shale and clay saprolite - "*Fenestella*" sp., *Orbiculoidea* sp., unidentified productid, Punctospirifer transversus: Community 2.

CH-2W-8 - 34°24'20"N 85°18'23"W - Red to brown clay saprolite - unidentified brachiopod, Pentremites sp., Echinoderm stem D: Unidentified community.

CH-2W-9 - 34°24'35"N 85°18'9"W - Red to brown clay saprolite - unidentified hapsiphyllid, Fistulipora sp., Lyropora sp., Inflatia inflata, Echinoconchus alternatus, Eumetria vera, Cleiothyridina sublamellosa, Composita subquadrata, Crurithyris sp., Spirifer leidyi, Brachythyris sp., Torynifer setigera, Echinoderm stems D, E, Archaeocidaris sp.: Community 4.

CH-2W-10 - 34°27'45"N 85°16'22"W - Red to brown clay and shale containing siliceous limestone and chert - Amplexizaphrentis spinulosus, unidentified hapsiphyllid, Lithostrotion (Siphonodendron) genevievensis, Michelinia sp., Palaeacis cuneiformis, Fenestella sp., Lyropora sp., Perditocardinia dubia, unidentified strophomenid, Composita sp., Spirifer leidyi, Torynifer setigera, Pentremites sp., Agassizocrinus sp., Echinoderm stem D, Archaeocidaris sp.: Community 5.

CH-2W-13 - 34°25'40"N 85°16'44"W - Brown to light brown shale, siltstone, and sandstone - Lingula cf. L. carbonaria: Community 1.

CH-2W-16 - 34°25'36"N 85°15'17"W - Red to brown shale overlain by sandstone - "*Fenestella*" sp., *Punctospirifer transversus*: Community 3.

CH-2W-19 - 34°28'59"N 85°15'28"W - Reddish brown clay saprolite and shale - *Amplexizaphrentis spinulosus*, unidentified hapsiphyllid, *Schuchertella* sp., unidentified strophomenid, *Eumetria costata*, *Cleiothyridina sublamellosa*, *Spirifer* sp., *Brachythyris* sp., *Reticulariina spinosa*, *Girtyella indianensis*, *Pentremites* sp., unidentified flexible, Echinoderm stems B, D: Community 4.

CH-3E-1 - 34°31'19"N 85°13'11"W - Brown shale and siltstone overlain by brown clay saprolite containing gray chert lenses - unidentified hapsiphyllid, *Acrocyathus floriformis*, *Michelinia* sp., *Fistulipora* sp., "*Fenestella*" sp., *Rhombopora* sp., *Orthotetes kaskaskiensis*, *Ovatia ovata*, unidentified productid, *Eumetria costata*, *Cleiothyridina sublamellosa*, *Composita* sp., *Crurithris* sp., *Spirifer arkansanus*?, *S. increbescens*, *S. leidyi*, *Brachythyris* sp., *Punctospirifer transversus*, *Reticulariina spinosa*, *Girtyella indianensis*, *Dielasma* sp., *Platyceras* (*Orthonychia*) sp., *Pentremites* sp., unidentified flexible, unidentified inadunate, Echinoderm stems C, D: Community 5.

CH-3E-2 - 34°31'9"N 85°13'32"W - Dark gray to black calcareous shale to argillaceous limestone overlain by yellow to brown clay saprolite containing chert fragments - unidentified hapsiphyllid, "*Fenestella*" sp., *Schizophoria* sp., unidentified strophomenid, *Chonetes chesterensis*, *Inflatia inflata*, unidentified productid, *Cleiothyridina sublamellosa*, *Composita subquadrata*, *Spirifer leidyi*, *Spirifer* sp., *Punctospirifer transversus*, *Dielasma* sp., *Girtyoceras* sp., Echinoderm stem D: Community 4.

CH-3E-3 - 34°30'40"N 85°14'2"W - Interbedded gray shale and limestone overlain by gray to dark gray calcareous shale - unidentified hapsiphyllid, *Michelinia* sp., "*Fenestella*" sp., *Inflatia inflata*, unidentified productid, unidentified rhynchonellid, *Cleiothyridina sublamellosa*, *Composita* sp., *Crurithyris* sp., *Spirifer leidyi*, *Punctospirifer transversus*, *Reticulariina spinosa*, *Girtyella indianensis*, *Pentremites* sp., *Talarocrinus* aff. *T. symmetricus*, Echinoderm stem C: Community 5.
Schellwienella sp., *Inflatia inflata*, *Echinoconchus alternatus*, unidentified productid, *Punctospirifer transversus*: Community 2?

CH-3E-4 - 34°30'24"N 85°14'28"W - Reddish to yellowish brown shale and clay saprolite - unidentified hapsiphyllid, "Fenestella" sp., Inflatia inflata, Composita sp., unidentified athyrid, Spirifer sp., Brachythyris sp., Echinoderm stem D: Community 4.

CH-3E-7 - 34°30'10"N 85°13'17"W - Brown shale and siltstone saprolite - unidentified hapsiphyllid, Michelinia sp., Archimedes sp., Composita sp., Spirifer leidyi, unidentified inadunate, Echinoderm stem D: Community 4.

CH-3E-10 - 34°33'39"N 85°9'54"W - Gray, finely crystalline limestone overlain by brown shale - Archimedes sp., unidentified gastropod: Unidentified community.

CH-3E-17 - 34°30'27"N 85°10'54"W - Gray to brown shale and siltstone - unidentified strophomenid: Unidentified community.

CH-3E-25 - 34°34'7"N 85°9'40"W - Brown siltstone and sandy shale - "Fenestella" sp., Ovatia ovata, unidentified productid, Reticulariina spinosa, Echinoderm stem D: Community 2.

CH-3E-28 - 34°32'36"N 85°12'17"W - Red clay saprolite containing siliceous limestone - Amplexizaphrentis spinulosus, unidentified hapsiphyllid, Lyropora sp., Cleiothyridina sublamellosa, Spirifer leidyi, Spirifer sp., Brachythyris sp., Punctospirifer transversus, Reticulariina spinosa, Girtyella indianensis, Pentremites sp., Zeacrinites sp., Echinoderm stems B, D, *Archaeocidaris* sp.: Community 5.

CH-3E-30 - 34°35'18"N 85°12'23"W - Red to yellow clay saprolite - *Cystelasma* sp., *Amplexizaphrentis spinulosus*, *Amplexizaphrentis* sp., *Zaphrentoides* sp., unidentified hapsiphyllid, *Lithostrotion proliferum*, *Striatopora* sp., *Michelinia* sp., *Cladochonus* cf. *C. beecheri*, *Fistulipora* sp., *Lyropora* sp., *Perditocardinia dubia*, *Orthotetes kaskaskiensis*, *Inflatia inflata*, *Ovatia ovata*, unidentified productid, *Eumetria costata*, *Cleiothyridina sublamellosa*, *Composita* sp., *Spirifer leidyi*, *Brachythyris* sp., *Punctospirifer transversus*, *Dielasma* sp., *Platyceras* (*Orthonychia*) sp., *Hadroblastus* sp., *Pentremites* sp., *Dichocrinus* cf. *D. huntsvillae*, *Talarocrinus* cf. *T. ovatus*, Echinoderm stem D: Community 5.

WA-3E-1 - 34°37'22"N 85°11'18"W - Red clay saprolite - *Lithostrotion proliferum*, *Konickophyllum* sp., *Michelinia* sp., *Agassizocrinus* sp., Echinoderm stems C, D: Community 5.

WA-3E-6 - 34°36'39"N 85°10'18"W - Light red to reddish brown clay saprolite - Echinoderm stem D: Unidentified community.

WA-3E-8 - 34°36'4"N 85°12'15"W - White to orange clay saprolite containing siliceous limestone -

Amplexizaphrentis spinulosus, Zaphrentoides sp., unidentified hapsiphyllid, Konickophyllum sp., Michelinia sp., Fistulipora sp., Schuchertella sp., Inflatia inflata, Ovatia ovata, unidentified productid, Cleiothyridina sublamellosa, Composita sp., Spirifer leidyi, Punctospirifer transversus, Reticulariina spinosa, Girtyella indianensis, Platyceras (Platyceras) sp., Pentremites sp., Echinoderm stems C, D, Archaeocidaris sp.: Community 5.

WA-3E-9 - 34°36'3"N 85°12'15"W - White to orange clay saprolite containing siliceous limestone (this locality is a southern extension of the large road cut described in part as WA-3E-8) - Amplexizaphrentis spinulosus, unidentified hapsiphyllid, Acrocyathus floriformis, "Fenestella" sp., Schuchertella sp., Inflatia inflata, Ovatia ovata, unidentified productid, Cleiothyridina sublamellosa, Composita subquadrata, Spirifer leidyi, Punctospirifer transversus, Torynifer setigera, Girtyella indianensis, Pentremites sp., Echinoderm stems C, D: Community 5.

WA-3E-11 - 34°36'26"N 85°11'36"W - Red clay saprolite and yellow shale - unidentified hapsiphyllid, Michelinia sp., Lyropora sp., unidentified productid, Spirifer sp., Echinoderm stem D: Community 4.

WA-3E-12 - 34°36'24"N 85°11'33"W - Red clay saprolite and yellow shale - Amplexizaphrentis spinulosus, unidentified hapsiphyllid, Chaetetes sp., Michelinia sp., Chonetes chesterensis, Inflatia inflata, Cleiothyridina sublamellosa, Spirifer sp., Echinoderm stem D: Community 4.

WA-3E-13 - 34°36'28"N 85°11'2"W - Red clay saprolite and yellow shale - unidentified productid, Spirifer sp., Echinoderm stem D: Unidentified community.

WA-3E-15 - 34°37'0"N 85°11'50"W - Brown siliceous limestone, shale, and silty shale - Rotiphyllum sp., Zaphrentoides sp., unidentified hapsyphyliid, Fistulipora sp., "Fenestella" sp., Crania sp., Schuchertella costatula, Chonetes chesterensis, Inflatia inflata, Flexaria arkansana, unidentified productid, Eumetria costata, Cleiothyridina sublamellosa, Composita subquadrata, Ambocoelia sp., Spirifer leidyi, Brachythyris sp., Punctospirifer transversus, Reticulariina spinosa, unidentified flexible, Echinoderm stem C: Community 4.

WA-3E-16 - 34°37'15"N 85°11'48"W - Yellowish brown soil containing siliceous limestone - Rotiphyllum sp., Zaphrentoides sp., unidentified hapsiphyllid, Palaeacis cuneiformis, Inflatia inflata, Ovatia ovata, unidentified productid, Composita subquadrata, Crurithyris sp., Spirifer leidyi, Brachythyris sp., Platyceras (Orthonychia) sp., Echinoderm stems C, D: Community 5.

WA-4E-2 - 34°38'14"N 85°10'35"W - Gray, finely crystalline to argillaceous limestone weathering to brown clay - Cystelasma sp., unidentified hapsiphyllid, Michelinia sp., Glyptopora sp., "Fenestella" sp., Lyropora sp., Inflatia inflata, unidentified productid, Eumetria costata, Cleiothyridina sublamellosa, Composita subquadrata, Spirifer leidyi, Reticulariina spinosa, Torynifer setigera, Girtyella indianensis, Dielasma arkansana, ?Dielasma sp., Euphemites sp., Ianthonopsis sp., Tylonautilus nodosocarinatus, Stroboceras sulcatum, ?Diorugoceras sp., ?Bistrialites sp., unidentified nautiloid, Goniatities cf. G. granosus, Schizodus sp., unidentified bivalve, Pentremites sp., Agassizocrinus sp., unidentified inadunate, Echinoderm stems C, D: Community 4.

WA-4E-4 - 34°40'51"N 85°10'33"W - Red clay saprolite containing thin chert beds and rubble - unidentified hapsiphyllid, Sulcoretepora sp., ?Schizophoria sp., Orthotetes kaskaskiensis, Inflatia inflata, Echinoconchus alternatus, Ovatia ovata, ?Ovatia sp., unidentified productid, Composita sp., Spirifer sp.: Community 4.

WA-4E-5 - 34°40'38"N 85°10'7"W - Red clay saprolite containing chert rubble - unidentified hapsiphyllid, "Fenestella" sp., unidentified productid, Cleiothyridina sublamellosa, Spirifer sp., Pentremites sp., Echinoderm stem D: Community 4.

WA-4E-8 - 34°39'15"N 85°10'8"W - Red clay saprolite containing chert rubble - Cystelasma sp., Amplexizaphrentis spinulosus, unidentified hapsiphyllid, Perditocardinia dubia, unidentified strophomenid, Spirifer sp., Echinoderm stems C, D: Community 4.

WA-4E-9 - 34°39'6"N 85°10'12"W - Red clay saprolite containing chert rubble - unidentified hapsiphyllid, "Fenestella" sp., Perditocardinia dubia, Cleiothyridina sublamellosa, Spirifer sp., Reticulariina spinosa, unidentifed terebratulid, Pentremites sp., Echinoderm stems C, D, E, Archaeocidaris sp.: Community 4.

WA-4E-11 - 34°38'33"N 85°10'14"W - Red clay saprolite - Amplexizaphrentis sp., unidentified hapsiphyllid, Michelinia sp., Fistulipora sp., Lyropora sp., Schizophoria sp., unidentified productid, Cleiothyridina sublamellosa, Spirifer sp., Reticulariina spinosa, unidentified terebratulid, Echinoderm stem: Community 4.

WA-4E-17 - 34°38'24"N 85°11'9"W - Red clay saprolite containing chert rubble - Cystelasma sp., unidentified hapsiphyllid, Lithostrotion proliferum, Michelinia sp., "Fenestella" sp., unidentified strophomenid, ?Laminatia sp., Inflatia inflata, unidentified productid, Cleiothyridina sublamellosa, Composita sp., Spirifer sp., Brachythyris sp., Dielasma sp., Platyceras (Orthonychia) sp., Pentremites sp., unidentified inadunate, Echinoderm stems C, D: Community 4.

WA-4E-18 - 34°38'15"N 85°10'42"W - Dark gray calcareous shale to argillaceous limestone - Michelinia sp., Orthotetes kaskaskiensis, Inflatia inflata, Composita sp., Spirifer leidyi, Echinoderm stem D: Community 4.

WA-4E-20 - 34°37'57"N 85°11'42"W - Red clay saprolite containing chert rubble - Amplexizaphrentis spinulosus, unidentified hapsiphyllid, Lithostrotion proliferum, Michelinia sp., Palaeacis cuneiformis, Palaeacis sp., Fistulipora sp., "Fenestella" sp., Lyropora sp., Orthotetes kaskaskiensis, Inflatia inflata, Cleiothyridina sublamellosa, Composita sp., Spirifer leidyi, Girtyella indianensis, Soleniscus sp., Aviculopecten sp., Cypricardella sp., Edmondia sp., Pentremites sp., Echinoderm stem D: Community 4.

WA-4E-21 - 34°37'33"N 85°11'44"W - Reddish brown clay saprolite and yellowish brown shale - unidentified hapsiphyllid, "Fenestella" sp., Echinoconchus sp., Composita sp., Pentremites sp., Echinoderm stems C, D: Community 4.

WA-4E-22 - 34°37'37"N 85°10'21"W - Limestone and shale saprolite containing siliceous limestone overlain by light brown sandstone - unidentified hapsiphyllid, Michelinia sp., Palaeacis cuneiformis, Fistulipora sp., Meekopora sp., Archimedes sp., Ovatia ovata, unidentified productid, Eumetria vera, Cleiothyridina sublamellosa, Composita sp., Spirifer leidyi, Reticulariina spinosa, Torynifer setigera, Girtyella indianensis, Pentremites sp., Agassizocrinus conicus, Agassizocrinus sp., unidentified inadunate, Echinoderm stems C, D: Community 5.

WA-4E-23 - 34°37'52"N 85°10'17"W - Brown shale overlain by red clay saprolite - unidentified hapsiphyllid, Fistulipora sp., "Fenestella" sp., Orthotetes kaskaskiensis, Echinoconchus alternatus, unidentified productid, Cleiothyridina sublamellosa, Composita sp., Girtyella indianensis, Dielasma arkansana, Streblopteria sp., Pentremites sp., Echinoderm stem C, Archaeocidaris sp.: Community 4.

WA-4E-24 - 34°38'9"N 85°10'17"W - Red clay saprolite containing chert and sandstone rubble - unidentified hapsiphyllid, Lyropora sp., Chonetes chesterensis, *Cleiothyridina sublamellosa*, *Spirifer* sp., *Punctospirifer transversus*, *Pentremites* sp., Echinoderm stems C, D: Community 4.

WA-4E-25 - 34°38'13"N 85°11'8"W - Red clay saprolite - unidentified hapsiphyllid, *Eumetria vera*, unidentified inadunate, Echinoderm stems C, D: Community 4.

WA-4E-26 - 34°37'49"N 85°11'6"W - Gray to dark gray limestone and calcareous shale - "*Fenestella*" sp., unidentified productid, *Composita* sp.: Community 2.

WH-5EE-3 - 34°48'5"N 85°7'4"W - Reddish brown clay saprolite - *Amplexizaphrentis spinulosus*, unidentified hapsiphyllid, "*Fenestella*" sp., *Inflatia inflata*, unidentified productid, *Cleiothyridina sublamellosa*, *Composita subquadrata*, unidentified athyrid, *Spirifer* sp., *Brachythyris* sp., *Pentremites* sp., unidentified inadunate, Echinoderm stem D: Community 4.

WH-5E-1 - 34°47'36"N 85°7'45"W - Yellow to red silty to sandy shale - "*Fenestella*" sp., *Lingula* cf. *L. carbonaria*: Community 1.

WH-5E-2 - 34°47'45"N 85°7'41"W - Dark gray calcareous silty shale - "*Fenestella*" sp., *Chonetes chesterensis*: Community 2.

WH-5E-5 - 34°48'5"N 85°7'42"W - Red clay saprolite - *Amplexizaphrentis* sp., unidentified hapsiphyllid, Cladochonus beecheri, Lyropora sp., unidentified productid, unidentified athyrid, Spirifer sp., Brachythyris sp.: Community 5.

CA-6EE-1 - 34°54'45"N 85°4'42"W - Gray cherty to argillaceous limestone - unidentified inadunate, Echinoderm stem D: Unidentified community.

CA-6EE-2 - 34°54'45"N 85°4'42"W - Gray oolitic to coarsely crystalline limestone - Lithostrotion proliferum, Michelinia sp., Fistulipora sp., Rhipidomella sp., unidentified productid, Cleiothyridina sublamellosa, Composita sp., Agassizocrinus sp., unidentified inadunate, Echinoderm stems C, D: Community 5.

CA-6EE-3 - 34°54'45"N 85°4'42"W - Gray to brown calcareous shale - Amplexizaphrentis spinulosus, unidentified hapsiphyllid, Michelinia sp., Fistulipora sp., "Fenestella" sp., Archimedes sp., Sulcoretepora sp., Schuchertella costatula, Chonetes chesterensis, Inflatia inflata, Echinoconchus alternatus, Flexaria arkansana, Ovatia ovata, unidentified productid, Cleiothyridina sublamellosa, Composita subquadrata, unidentified athyrid, Spirifer leidyi, Punctospirifer transversus, ?Dielasma sp., Pentremites sp., Agassizocrinus sp., Stiberostaurus aestimatus, Echinoderm stems C, D, Archaeosigillaria sp.: Community 4.

CA-6EE-4 - 34°59'2"N 85°3'31"W - Red to brown clay saprolite - Amplexizaphrentis spinulosus, unidentified hapsiphyllid, Chaetetes sp., Michelinia sp., Archimedes sp., Lyropora sp., Rhipidomella sp., Schuchertella costatula, Inflatia inflata, unidentified productid, Eumetria costata, Cleiothyridina sublamellosa, Composita subquadrata, Spirifer leidyi, Brachythyris sp., Punctospirifer transversus, Reticulariina spinosa, unidentified gastropod, Stroboceras sulcatum, Schizodus sp., Pentremites sp., Talarocrinus cf. T. symmetricus, Agassizocrinus sp., Echinoderm stems C, D: Community 5.

CA-6EE-5 - 34°54'37"N 85°4'37"W - Red, yellow, and black shale overlain by thin-bedded silty sandstone - Michelinia sp., "Fenestella" sp., Archimedes sp., Sulcoretepora sp., Cleiothyridina sublamellosa, Spirifer sp., Pentremites sp., Echinoderm stem D: Community 4.

CA-6EE-7 - 34°55'2"N 85°4'25"W - Red clay saprolite to red to yellow shale containing siliceous limestone lenses - Amplexizaphrentis spinulosus, unidentified hapsiphyllid, Fistulipora sp., "Fenestella" sp., unidentified productid, Cleiothyridina sublamellosa, Composita subquadrata, Spirifer sp., Punctospirifer transversus, Reticulariina spinosa, Torynifer setigera, Dielasma sp., Agassizocrinus conicus, Agassizocrinus sp., unidentified inadunate, Echinoderm stems D, E: Community 5.

CA-6EE-8 - 34°55'26"N 85°4'18"W - Red clay saprolite - Lithostrotion proliferum, Michelinia sp., "Fenestella" sp.: Community 5.

CA-6EE-9 - 34°55'44"N 85°4'18"W - Red clay saprolite and red to yellow shale - Lithostrotion proliferum, Lyropora sp.: Community 5.

CA-6EE-10 - 34°56'N 85°4'18"W - Red clay saprolite and red to yellow shale - Amplexizaphrentis spinulosus, unidentified hapsiphyllid, Chaetetes sp., Archimedes sp., Eumetria costata, Cleiothyridina sublamellosa, Echinoderm stem D: Community 5.

CA-6EE-11 - 34°56'49"N 85°3'45"W - Yellow to red shale - unidentified hapsiphyllid, "Fenestella" sp., Archimedes sp., Echinoderm stems C, D: Community 4.

CA-6EE-12 - 34°57'27"N 85°3'6"W - Gray shale weathering greenish brown - "Fenestella" sp., Composita sp.: Community 3.

CA-6EE-13 - 34°56'47"N 85°3'33"W - Gray shale weathering greenish brown - "Fenestella" sp., unidentified rhynchonellid, Composita sp., Echinoderm stem D: Community 3.

CA-6EE-14 - 34°57'46"N 85°4'7"W - Red clay saprolite - unidentified hapsiphyllid, Fistulipora sp., Lyropora sp., Orthotetes kaskaskiensis, Chonetes chesterensis, unidentified terebratulid, unidentified flexible, Agassizocrinus sp., Echinoderm stem D: Community 4.

CA-6EE-16 - 34°57'23"N 85°4'25"W - Reddish brown clay saprolite - Cystelasma sp., Amplexizaphrentis spinulosus, Amplexizaphrentis sp., unidentified hapsiphyllid, Lithostrotion proliferum, L. (Siphonodendron) genevievensis, Michelinia sp., Cladochonus beecheri, Perditocardinia dubia, Inflatia inflata, Cleiothyridina sublamellosa, Spirifer leidyi, Brachythyris sp., Punctospirifer transversus, unidentified terebratulid, Pentremites sp., Echinoderm stem D: Community 5.

CA-6EE-18 - 34°56'19"N 85°4'56"W - Reddish brown clay saprolite containing chert rubble - unidentified hapsiphyllid, Lithostrotion proliferum, Lyropora sp., Perditocardinia dubia, unidentified productid, Spirifer sp., Echinoderm stem D: Community 4.

CA-6EE-19 - 34°53'44"N 85°4'31"W - Gray to dark gray coarsely crystalline to cherty fine limestone weathers to reddish brown clay saprolite - Cystelasma sp., unidentified hapsiphyllid, Lithostrotion *proliferum*, *Chaetetes* sp., *Palaeacis cuneiformis*, *Lyropora* sp., unidentified productid, *Spirifer* sp., *Pentremites* sp., *Stiberostaurus aestimatus*, Echinoderm stems C, D: Community 5.

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PLATES

PLATE 2

Rugosa, Conulariida

All figures are of silicified specimens except 24.

Figure

1-3, 9 - Zaphrentoides sp. - 1, 2, locality CH-3E-30: strongly curved corallite, side view, X1; calical view, X2, 1072TX6. 3, 9, locality WA-3E-16: side view, X1; calyx, X1.75, 1067TX2.

4, 10 - Rotiphyllum sp. - locality WA-3E-16: side view, X1; calical view, X1.75, 1067TX1.

5, 6, 11 - Cystelasma sp. - locality CH-3E-30: 5, 6, small individual with epithecal talons, calyx, X2; side view, X1.5, 1072TX1. 11, specimen showing regeneration and talons, side view, X1.5, 1072TX2.

7, 12 - Amplexizaphrentis spinulosus (Milne-Edwards & Haime) - locality CH-3E-30: calyx, X1.5; side view, X1, 1072TX3.

8 - Unidentified hapsiphyllid - locality CH-3E-30: calical view of weathered specimen, X2, 1072TX7.

13, 14 - Amplexizaphrentis sp. - locality CH-3E-30: 13, side view, X1, 1072TX4. 14, longitudinal section of specimen showing tabulae, X1.5, 1072TX5.

15, 16, 21 - Koninckophyllum sp. - 15, 16, locality WA-3E-8: 15, side fiew of contorted corallite, X1, 1063TX1; 16, longitudinal section of another specimen, X1.5,

PLATE 2

1063TX2. 21, locality WA-3E-1; large calyx, X1.5, 1062TX1.

17, 18 - Lithostrotion proliferum Hall - 17, locality CA-6EE-8: large individual with budding on calical lip, X0.8, 1048TX1. 18, locality CA-6EE-2: calical view of small colony, X1.5, 1044TX2.

19, 20 - Lithostrotion (Siphonodendron) cf. L. (S.) genevievensis Easton - locality CA-6EE-16: 19, transverse section of a single corallite, X2.5, 1052TX1. 20, side view of part of colony, X1.5, 1052TX2.

22, 23 - Acrocyathus cf. A. floriformis d'Orbigny - 22, locality WA-3E-9: top of fragment of a colony, X1, 1064TX1. 23, locality CH-3E-1: transverse section of part of a colony, X2, 1068TX1.

24 - Paraconularia sp. - locality F-1E-26: side view of uncrushed specimen with unidentified productid brachiopods in siderite nodule, X2, 1095TX1.

PLATE 3

Tabulata

All figures are of silicified specimens.

Figure

1, 8 - *Syringopora* sp. - locality F-1E-22: calical, lateral views of part of a small colony, X3, 1093TX1.

2, 3, 9 - *Striatopora* sp. - locality F-1WW-1: 2, 9, transverse, longitudinal sections, X2. 3, lateral view of part of same specimen, X1.75, 1103TX1.

4-7, 11, 16 - *Palaeacis cuneiformis* Milne-Edwards & Haime - 4-7, locality CH-2W-10: 4, 6, calical, lateral views of small colony, X3, 1077TX1. 5, 7, calical, lateral views of larger colony, X2, 1077TX2. 11, 16, locality WA-4E-22: lateral view of part of a colony, X2.5; detail of mural pores in one calyx, X5, 1060TX1.

10, 15 - *Palaeacis* sp. - locality WA-4E-20: recumbent form with at least four large calices, calical view, X1.75; detail of mural pores in one calyx, X3.5, 1059TX1.

12-14 - *Cladochonus* cf. *C. beecheri* (Grabau) - locality WH-5E-5: 12, 13, calical, lateral view of part of colony with pointed termination, X3, 1054TX1. 14, lateral view of part of colony that has broken, X3, 1054TX2.

PLATE 3

17-21 - Chaetetes sp. - 17, 18, locality WA-3E-12: basal, lateral views of small colony, X1.25, 1065TX1. 19-21, locality CA-6EE-10: 19, lateral view of broken surface of colony, X1.5, 1050TX1. 20, 21, transverse and longitudinal sections through part of another colony, X6, 1050TX2.

22-27 - Michelinia sp. - 22, 24, locality CH-3E-30: top, lateral views of a planated colony, X2.5, 1072TX8. 23, 27, locality CH-3E-30: top, lateral views of a more three dimensional type with subcircular calices, X2, 1072TX9. 25, locality F-2E-17: longitudinal section of part of colony with large, polygonal calices, X2, 1084TX1. 26, locality CA-6EE-4: calical view of part of a colony with large, polygonal calices, X1.5, 1046TX1.

PLATE 4

Bryozoa

All figures are of silicified specimens except 17, 25, and 26.

Figure

1, 2, 5, 10 - *Archimedes* spp. - 1, 10, locality CA-6EE-11: large, complete axis, lateral view, X1.5; detail of transverse section, X4, 1051TX1. 2, 5, locality CA-6EE-5: small, loosely coiled left-handed axis, lateral view, X1.5, 1047TX1; larger, tightly coiled, right-handed axis, lateral view, X1.5, 1047TX2.

3, 4, 6-8 - "*Lyropora*" sp. - 3, 4, 8, locality CH-3E-30: 3, transverse section of support axis showing laminar structure and frond base, X2, 1072TX10. 4, 8, top edge of axis, X2; oblique transverse section showing part of frond, X3, 1072TX11. 6, locality CA-6EE-4: lateral view of "V"-shaped support, X2, 1046TX2. 7, locality CA-6EE-9: lateral view of broad, "U"-shaped support, X2, 1049TX1.

9, 11-13, 16, 18, 19, 21 - "*Fistulipora*" spp. - 9, 11, 12, locality F-2E-1: 9, lateral view of part of thin, ramose colony, X2, 1079TX2. 11, 12, transverse section, X3.5; lateral view, X2, of thin, ramose colony, 1079TX3. 13, locality F-2E-2: lateral view of part of ramose colony with large zooecia, X2.5, 1080TX1. 16, 19, locality F-1E-22: part of thick, ramose

PLATE 4

colony, transverse section, X3; lateral view, X2, 1093TX2. 18, 21, locality F-2E-1: laminar form, longitudinal section, X2.5; surface of colony, X2, 1079TX1.

14, 15 - ?Meekopora sp. - locality WA-4E-22: lateral views of part of a colony, X3, 1060TX2.

17 - Penniretepora sp. - locality F-2E-2: mold of part of frond in shale, X2, 1080TX2.

20 - Glyptopora sp. - locality WA-4E-2: two folia of colony, X1.5, 1055TX1.

22, 23 - Rhombopora spp. - locality CH-3E-1: detail of part of colony with parts of other ?Rhombopora (small zooaria), X6; fragments of Rhombopora and "Fenestella" including those in figure 22 in pedicle valve of unidentified strophomenid brachiopod, X1.5, 1068TX2.

24 - Sulcoretepora sp. - locality WA-4E-4: parts of two colonies, X2.5, 1056TX1.

25 - Polypora sp. - locality CH-2E-19: part of colony preserved as a mold in siltstone, X2.5, 1075TX1.

26 - "Fenestella" sp. - locality WA-4E-23: molds of parts of several fronds in shale, X1.25, 1061TX1.

PLATE 5

Inarticulata, Rhynchonellida, Terebratulida

All figures are of silicified specimens except 1-10, 12, 19, 20, 33, and 37.

Figure

1, 2 - Lingula aff. L. carbonaria Shumard - 1, locality F-3EE-1: part of valve in shale, X2, 1078TX1. 2, locality F-1W-11: part of one valve imbedded in silty shale, X2, 1101TX1.

3 - ?Trigonoglossa sp. - locality F-2E-3: part of one valve in shale, X1.5, 1081TX1.

4-6 - Orbiculoidea sp. - locality F-2E-3: dorsal, ventral, and lateral views, X2, 1081TX2.

7-9 - Leiorhynchoidea carboniferum (Girty) - 7, 8, locality F-1E-24: dorsal, ventral views of internal mold composed of siderite, X1.25, 1094TX1. 9, locality F-1E-43: dorsal view of part of individual imbedded in silty shale, X1.5, 1098TX1.

10 - Oehlertella sp. - locality F-1E-26: siderite nodule containing parts of dorsal valves of three individuals, X1.5, 1095TX2.

11 - Crania sp. - locality F-1W-2: two individuals attached to the ventral valve of an unidentified productid brachiopod, X1.5, 1100TX1.

12-15 - ?Pugnoides ottumwa (White) - 12, locality F-2E-55: dorsal view of crushed individual in shale, X 1.5,

PLATE 5

1085TX1. 13-15, locality F-1W-2: lateral, anterior, and dorsal views, X 1.5, 1100TX2.

16-18, 21-26 - Girtyella indianensis (Girty) - 16, 21, 24, locality F-1WW-1: dorsal, anterior, lateral views of specimen with bilobed anterior and uniplicate commissure, X1.5, 1103TX3. 17, 22, 25, locality WA-4E-22: dorsal, anterior, lateral views of specimen with slightly trilobed anterior and uniplicate commissure. X1.5, 1060TX4. 18, 23, 26, locality WA-3E-8: dorsal, anterior, lateral views of individual with trilobed anterior and slightly uniplicate commissure, X1.5, 1063TX4.

19, 20 - Unidentified rhynchonellids - locality F-1E-38: molds of isolated dorsal and ventral valves in silty shale, X1.5, 1097TX1, 1097TX2.

27, 28, 34 - ?Dielasma sp. - locality WA-4E-2: dorsal, anterior, lateral views, X1.5, 1055TX9.

29-32, 35, 36 - Dielasma arkansanum Weller - locality WA-4E-2: 29, 30, 35, dorsal, anterior, lateral views of type with rounded anterior and rectimarginate commissure, X1.5, 1055TX7. 31, 32, 36, anterior, dorsal, lateral views of type with "squared" anterior and uniplicate commissure, X1.5, 1055TX8.

33, 37 - Dielasma inflata Weller - locality F-1E-12: lateral and dorsal views of part of individual, X2, 1092TX1.

PLATE 6

Orthida, Strophomenida

All figures are of silicified specimens except 14.

Figure

1-4 - Perditocardinia dubia (Hall) - Locality CH-2W-10: 1, ventral exterior, X1.5, 1077TX3. 2, 4, dorsal exterior and interior, X1.5, 1077TX4. 3, ventral interior, X1.5, 1077TX5.

5-7, 10, 11 - Rhipidomella sp. - 5, 6, 10, locality CA-6EE-2: ventral, dorsal views, X1.5; posterior view, X1.3, 1044TX1. 7, 11, locality CA-6EE-4: external and internal views of dorsal valve, X 1.5, 1046TX3.

8, 12, 13 - Chonetes chesterensis Weller - 8, locality WA-3E-15: ventral part of internal mold with spines directed apically along posterior margin, X3, 1066TX4. 12, 13, ventral, dorsal views X2, 1084TX3.

9 - ?Schizophoria sp. - locality WA-4E-4: ventral view of part of internal mold, X1.75, 1056TX2.

14 - Schellwienella sp. - locality CH-3E-3: ventral valve and parts of several others, X1, 1070TX1.

15, 17, 20, 21 - Schuchertella costatula (Hall & Clarke) - locality WA-3E-15: 15, 17, ventral, dorsal views of large individual with Crania sp. attached to the dorsal valve, X1, 1066TX1. 20, dorsal view of smaller individual, X1, 1066TX2. 21, ventral valve interior, X1.25, 1066TX3.

PLATE 6

16 - Schuchertella sp. - locality F-2E-17: parts of several individuals attached to each other. X1.5, 1084TX2.

18, 19 - Orthotetes kaskaskiensis (McChesney) - locality WA-4E-23: posterior, dorsal views, X1, 1061TX2.

22-24 - Heteralosia sp. - locality F-1E-36: 22, ventral view, X1.5, 1096TX1. 23, 24, block containing several individuals and fragments of unidentified bryozoans and productid brachiopods, X1; detail of same showing ventral views of two individuals, X2, 1096TX2.

PLATE 7

Productacea

All figures are of silicified specimens except 1, 2, 4, 23.

Figure

1, 2, 4-6 - Inflatia inflata (McChesney) - 1, 2, 4, locality CH-3E-3: posterior, ventral, lateral views, X1, 1070TX2. 5, locality WH-5EE-3: interior of ventral valve, X1.25, 1053TX1. 6, locality WA-3E-16: dorsal view, X1.25, 1067TX3.

3, 7, 8 - Ovatia ovata (Hall) - 3, locality WA-3E-8: lateral view of part of large specimen, X1, 1063TX3. 7, 8, locality WA-4E-22: lateral, ventral views, X1, 1060TX3.

9-11, 14-16, 18, 19 - Echinoconchus biseriatus (Hall) - locality F-2E-1: 9, 14, 15, ventral, dorsal, lateral views of a nearly complete specimen, X2.5, 1079TX4. 10, 11, 16, ventral, dorsal, lateral views of a smaller individual, X2.5, 1079TX5. 18, 19, dorsal, lateral views of a relatively large individual, X1, 1079TX6.

12 - ?Ovatia sp. - locality WA-4E-4: posteroventral view, X2, 1056TX4.

13 - ?Laminatia sp. - locality WA-4E-17: fragment of ventral valve with spines on raised laminae, X1.25, 1058TX1.

17, 21, 23, 24 - Flexaria arkansana (Girty) - 17 locality F-1E-2: fragments and impressions of several

PLATE 7

individuals in deeply weathered siliceous limestone, X1.25, 1090TX1. 21, 24, locality F-2E-1: ventral, dorsal views of fractured specimen, X1.5, 1079TX7. 23, locality F-1E-26: ventrolateral view of specimen in a siderite nodule. The small, elongate mold is the nuculoid bivalve *Phestia*, X2, 1095TX3.

20, 26 - *Echinoconchus alternatus* (Norwood & Pratten) - 20, locality WA-4E-23: dorsal view, X1, 1061TX3. 26, locality WA-4E-4: ventral view of poorly preserved specimen, X1, 1056TX3.

22, 25 - *Protoniella parva* (Meek & Worthen) - locality CH-2E-17: ventral, dorsal views, X3, 1073TX1.

PLATE 8

Spiriferida

All figures are of silicified specimens except 3, 8, 14, 15, 24, 27, 29, and 30.

Figure

1, 6, 11, 13 - Ambocoelia sp. - locality WA-3E-15: dorsal, posterior, lateral, ventral views, X3, 1066TX5.

2, 3, 7, 8, 12, 14, 15 - Crurithyris sp. - 2, 7, 12, locality WA-3E-16: dorsal, posterior, lateral views, X3, 1067TX4. 3, 8, 14, 15, locality CH-3E-2: dorsal, posterior, ventral, lateral views, X3, 1069TX1.

4, 5, 9, 10, 16, 17 - Torynifer setigera (Hall) - 4, 5, 9, 10, locality WA-3E-9: dorsal, posterior, ventral, lateral views, X2, 1064TX2. 16, locality CH-2W-9: interior of ventral valve with parts of the spiralia, X2, 1076TX3. 17, locality F-2E-2: anterior view of large individual, X1.25, 1080TX7.

18-20, 22, 23 - Spirifer leidyi Norwood & Pratten - 18, 20, locality F-2E-1: posterior view, X2, 1079TX8; anterior view of another specimen, X2, 1079TX9. 19, 22, 23, locality WA-3E-15: posterior, lateral, dorsal views, X2, 1066TX6.

21 - Spirifer increbescens Hall - locality CH-3E-1: ventral view of large, crushed specimen, X1, 1068TX3.

24, 27, 29, 30 - Spirifer arkansanus Girty - 24, locality F-1E-9: longitudinal section of anterior part of

PLATE 8


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PLATE 8

Spiriferida

All figures are of silicified specimens except 3, 8, 14, 15, 24, 27, 29, and 30.

Figure

1, 6, 11, 13 - Ambocoelia sp. - locality WA-3E-15: dorsal, posterior, lateral, ventral views, X3, 1066TX5.

2, 3, 7, 8, 12, 14, 15 - Crurithyris sp. - 2, 7, 12, locality WA-3E-16: dorsal, posterior, lateral views, X3, 1067TX4. 3, 8, 14, 15, locality CH-3E-2: dorsal, posterior, ventral, lateral views, X3, 1069TX1.

4, 5, 9, 10, 16, 17 - Torynifer setigera (Hall) - 4, 5, 9, 10, locality WA-3E-9: dorsal, posterior, ventral, lateral views, X2, 1064TX2. 16, locality CH-2W-9: interior of ventral valve with parts of the spiralia, X2, 1076TX3. 17, locality F-2E-2: anterior view of large individual, X1.25, 1080TX7.

18-20, 22, 23 - Spirifer leidyi Norwood & Pratten - 18, 20, locality F-2E-1: posterior view, X2, 1079TX8; anterior view of another specimen, X2, 1079TX9. 19, 22, 23, locality WA-3E-15: posterior, lateral, dorsal views, X2, 1066TX6.

21 - Spirifer increbescens Hall - locality CH-3E-1: ventral view of large, crushed specimen, X1, 1068TX3.

24, 27, 29, 30 - Spirifer arkansanus Girty - 24, locality F-1E-9: longitudinal section of anterior part of

PLATE 8

specimen containing geopetal structure. Lower limit of crystalline calcite is marked by thin blades of the spiralium, X1.5, 1091TX1. 27, locality F-1E-26: internal mold of ventral valve, X1, 1095TX4. 29, 30, locality F-2E-3: dorsal view of crushed specimen, X1, 1081TX3; posterior view of another individual, X1, 1081TX4.

25, 26, 28 - *Brachythyris* sp. - locality CH-2W-9: 25, 28, dorsal, ventral views of slightly crushed specimen, X1.5, 1076TX1. 26, posterior view of another individual, X1.5, 1076TX2.

PLATE 9

Spiriferida

All figures are of silicified specimens except 12-14.

Figure

1-3, 5, 6, 9 - Reticulariina spinosa (Norwood & Pratten) - locality WA-4E-2: 1, 5, posterior, anterior views of small specimen, X1.5, 1055TX4. 2, 3, 6, dorsal, lateral, ventral views of larger individual, X1.5, 1055TX5. 9, interior of ventral valve with spiralium, X2, 1055TX6.

4, 7, 8, 10, 11 - Punctospirifer transversus (McChesney) - 4, 7, 8, locality CH-3E-1: posterior, lateral, anterior views, X2, 1068TX4. 10, 11, locality WA-3E-15: dorsal, ventral views, X2, 1066TX7.

12-14 - ?Dimegelasma sp. - locality F-2E-3: dorsal, ventral, lateral views, X2.5, 1081TX5.

15, 16, 20, 23 - Composita subquadrata (Hall) - 15, 23, locality CA-6EE-3: dorsal, ventral views, X1.5, 1045TX1. 16, 20, locality F-1WW-1: anterior, lateral views, X1.5, 1103TX2.

18, 19, 21, 22 - Composita sp. A - locality F-2E-2: 18, 21, anterior, lateral views of an average size individual, X3, 1080TX5. 19, 22, dorsal, anterior views of another specimen, X3, 1080TX6.

17, 24, 28, 29 - Eumetria vera (Hall) - locality F-2E-2: 17, 24, dorsal, lateral views, X2, 1080TX3. 28, 29,

PLATE 9


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dorsal, ventral views of smaller individual, X2, 1080TX4.

30, 31, 33 - Eumetria costata (Hall) - locality WA-4E-2: 30, dorsal view of large specimen, X1.25, 1055TX2. 31, 33, dorsal, lateral views of smaller specimen, X1.5, 1055TX3.

25-27, 32, 34 - Cleiothyridina sublamellosa (Hall) - 25-27, 32, locality F-2E-17: dorsal, lateral, ventral, anterior views, X1.75, 1084TX4. 34, locality F-2W-3: dorsal view showing parts of several spine lamellae on anterior part of the valve, X2, 1088TX1.

PLATE 10

Gastropoda

All figures are of silicified specimens except 3-5, 8, 10, 16, 19, 20, 24-26, 30-33.

Figure

1, 2, 7 - Bellerophon (Bellerophon) sp. - 1, locality F-2E-1: lateral view, X2, 1079TX10. 2, 7, locality F-1W-2: dorsal, apertural views, X2, 1100TX3.

3, 8 - Knightites (Retispira) bellireticulata Knight - locality F-2E-3: lateral, dorsal views, X4, 1081TX9.

4, 5, 10 - Euphemites sp. - locality F-2E-3: 4, lateral view, X2, 1081TX6; 5, dorsal view of small individual, X2, 1081TX7; 10, apertural view, X2, 1081TX8.

6 - Platyceras (Platyceras) sp. - locality WA-3E-8: apical-lateral view, X2, 1063TX5.

9, 11, 15 - Straparolus (Euomphalus) sp. - locality CH-2E-18: 9, apical view of small individual, X2, 1074TX1. 11, 15, apertural, basal views of larger specimen, X2, 1074TX2.

12, 13 - Platyceras (Orthonychia) sp. - locality WA-3E-16: lateral, apical-lateral views, X2, 1067TX5.

16, 19, 20, 24 - Glabrocingulum (Glabrocingulum) sp. - 16, 24, locality F-2E-3: abapertural view of partly crushed specimen, X2, 1081TX12; apertural view of small individual, X2, 1081TX13. 19, 20, locality F-2E-55: apertural, apical views, X2, 1085TX2.

PLATE 10


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14, 17, 18, 21, 22 - Euconospira sp. - 14, 21, 22, locality F-2E-1: 14, basal view showing open umbilicus in small individual, X2, 1079TX11. 21, 22, apical, apertural views of large, conical specimen, X2, 1079TX12. 17, 18, locality F-2E-2: apical, apertural views of a more "stairstep" form, X2, 1080TX9.

23 - Rhineoderma piasaensis (Hall) - locality F-2E-2: apical view, X2, 1080TX8.

25, 26 - Rhineoderma sp. - locality F-1E-26: apical, apertural views X2, 1095TX5.

27 - Ianthanopsis sp. - locality WA-4E-2, abapertural view, X2, 1055TX10.

28, 34 - ?Soleniscus sp. - locality F-2E-1: apertural, abapertural views, X2, 1079TX13.

29 - Soleniscus sp. - locality WA-4E-20: abapertural view, X2, 1059TX2.

30-33 - Trepospira (?Angyomphalus) sp. 30, 31, locality F-1E-26: apertural, apical views, X2, 1095TX6. 32, 33, locality F-2E-3: apical, basal views of two large, crushed individuals, X2, 1081TX10, 1081TX11.

35 - Worthenia tabulata (Conrad) - locality F-1WW-1: abapertural view, X2, 1103TX4.

PLATE 11

Bivalvia

All figures are of silicified specimens except 3-6, 9-12, 14, 17, 20, 21.

Figure

1-3 - *Phestia* sp. - 1, 2, locality F-1W-2: left, hinge views, X2, 1100TX4. 3, locality F-2E-55: left view showing part of taxodont dentition on right valve, X3, 1085TX4.

4, 9 - *Nuculopsis* sp. - locality F-2E-55: hinge, left views, X2, 1085TX3.

5, 6, 10, 11, 14 - *Clinopistha* sp. - 5, 10, 14, locality F-2E-3: 5, 10, left, hinge views, X2, 1081TX18. 14, right view of partly disarticulated valves showing taxodont dentition on left valve, X2, 1081TX19. 6, 11, locality F-1E-26: left, hinge views of internal mold, X2, 1095TX7.

7 - *Schizodus* sp. - locality CA-6EE-4: left valve, X1.5, 1046TX4.

8 - *Cypricardella* sp. - locality WA-4E-20: part of right valve, X2, 1059TX3.

12 - *Wilkingia* sp. - locality F-2E-55: left valve, X2, 1085TX5.

13 - *Edmondia* sp. - locality WA-4E-20: left valve, X1.5, 1059TX4.

PLATE 11

15, 16, 18 - Permophorus sp. - 15, locality F-2E-2: left valve, X2, 1080TX11. 16, 18, locality F-1W-2: left, hinge views of larger, less ornamented form, X2, 1100TX5.

17 - ?Caneyella sp. - locality F-2E-12: mold of reticulate shell in shale, X2, 1082TX1.

19 - Streblopteria sp. - locality WA-4E-23: right valve, X1.5, 1061TX4.

20, 21 - Aviculopecten sp. - 20, locality F-2E-3: valve interior, X2, 1081TX20. 21, locality F-0E-1: right valve, X1.5, 1104TX1.

PLATE 12

Nautiloidea

All figures are of silicified specimens except 1, 2, 4, 5, 15, 17, and 18.

Figure

1, 2 - Pseudorthoceras stonense Gordon - locality F-2E-3: external longitudinal view; part of same, polished longitudinal section showing internal structures of camerae, X3.2, 1081TX14.

3 - ?Pseudorthoceras sp. - locality F-2E-2: longitudinal section of poorly preserved conch, X2, 1080TX10.

4, 5 - Mitorthoceras crebriliratum (Girty) - locality F-2E-3: polished longitudinal section showing structure of three camerae; exterior showing arrangement of lirae, X3.6, 1081TX15.

6, 7 - ?Bistrialites sp. - locality WA-4E-2: ventral, lateral views X1.5, 1055TX14.

8, 9, 12, 13, 15, 17, 18 - Tylonautilus nodosocarinatus (Roemer) - 8, 9, 12, 13, locality WA-4E-2: 8, 9, lateral view of part of mold; internal view showing traces of septa, X1, 1055TX11. 12, 13, ventral, lateral views, X1.1, 1055TX12. 15, 17, 18, locality F-2E-3: cross section of venter showing reduced expression of lirae on internal mold; lateral view, X1.8; ventral view, X1.3, 1081TX16.

PLATE 12

10, 16 - <u>Stroboceras sulcatum</u> (Sowerby) - locality CA-6EE-4: lateral, ventral views, X1.1, 1046TX5.

11, 14 - ?<u>Diorugoceras</u> sp. - locality WA-4E-2: lateral view showing small umbilicus; ventral view showing sinuous suture on venter (this specimen may belong in the highly compressed ammonoids), X1.5, 1055TX13.

PLATE 13

Ammonoidea, Trilobita

Figures 1, 2, 12, 13 are of silicified specimens.

Figure

1, 2 - Girtyoceras sp. - locality CH-3E-2: apertural, umbilical views, X2, 1069TX2.

3, 4 - Neoglyphioceras subcirculare (Miller) - locality F-1E-22: apertural, umbilical views, X2, 1093TX3.

5 - ?Neoglyphioceras sp. - locality F-1E-46: umbilical view of crushed specimen in shale, X2, 1099TX1.

6, 7 - Unidentified trilobites - 6, locality F-1E-9: part of median lobe of thorax, X3, 1091TX2. 7, locality F-2E-12: thorax, X2, 1082TX2.

8, 9 - Cravenoceras sp. - locality F-1W-23: ventral views of crushed specimen, X2, 1102TX1.

10, 11, 15 - Kaskia sp. - locality F-2E-3: 10, cephalon with other fragments in shale, X1, 1081TX21. 11, pygidium in shale, X1, 1081TX22. 15, parts of three cephalons in shale, X1, 1081TX23.

12, 13 - Goniatites aff. G. granosus Portlock - locality WA-4E-2: ventral, umbilical views, X1.25, 1055TX15.

14, 16-19 - Lyrogoniatites newsomi georgiensis Miller & Furnish - 14, locality F-1E-24: sideritized specimen showing sutures, X1.5, 1094TX2. 16, 17, locality F-2E-3: ventral, umbilical views of partly crushed

PLATE 13

specimen, X2, 1081TX17. <u>18</u>, <u>19</u>, locality F-1E-1: latex cast counterparts of the interior of a large siderite nodule, X1, 1089TX1.

PLATE 14

Crinoidea

All specimens figured are silicified.

Figure

1, 6 - Unidentified flexible - locality F-2E-1: ventral, lateral views of part of proximal stem with fused infrabasals, X2, 1079TX14.

2, 3 - Unidentified flexible - locality WA-4E-8: lateral exterior, distal articular views of a brachial, X2, 1057TX1.

4, 5 - Phanocrinus formosus (Worthen) - locality F-1WW-1: dorsal, posterior views of dorsal cup, X1.5, 1103TX5.

7, 8 - ?Forbesiocrinus sp. - lateral exterior, lateral articular views of interbrachial, X2, 1073TX2.

9-11, 16, 17, 19, 20 - Agassizocrinus sp. - 9, 16, 19, locality CA-6EE-3: dorsal, ventral, lateral views of planated infrabasal circlet with basal concavity, X1.5, 1045TX2. 10, locality WA-4E-22: external lateral-articular view of isolated radial, X1.5, 1060TX6. 11, locality CA-6EE-3: exterior view of isolated ?basal, X1.5, 1045TX4. 17, 20, locality CA-6EE-3: ventral, lateral views of bowl-shaped infrabasal circlet, X1.5, 1045TX3.

12 - Pentaramicrinus fragosus (Sutton & Winkler) - locality F-2E-1: D ray view of crown, X1.5, SUI 35505.

PLATE 14


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13 - Phanocrinus alexanderi Strimple - locality F-2E-1: A ray view of crown, X1.5, SUI 35503.

14, 15 - Zeacrinites sp. - locality F-1WW-1: dorsal, posterior views of dorsal cup, X1.5, 1103TX7.

18, 21 - Agassizocrinus conicus Owen & Shumard - locality WA-4E-22: ventral, lateral views of infrabasal circlet, X1.5, 1060TX5.

22 - Linocrinus sp. - locality F-2E-1: dorsal view of crown, X1.5, SUI 35511.

23 - Zeacrinites doverensis Miller and Gurley - locality F-1WW-1: posterior view of crown, X1.5, 1103TX6.

24, 29, 30 - Ulrichicrinus chesterensis Strimple - locality F-2E-1: posterior, C ray, A ray views of crown, X1.5, SUI 35513.

25 - Tholocrinus wetherbyi (Wachsmuth & Springer) - locality F-2E-1: D ray view of crown, X1.5, SUI 35512.

26 - Aphelecrinus popensis (Worthen) - locality F-2E-1: anterior (A ray) view of crown, X1.5, SUI 35509.

27, 28 - Aphelecrinus sp. - locality F-2E-1: 27, part of large anal tube, X1.5, 1079TX15. 28, anterior (A ray) view of juvenile crown, X1.5, 1079TX16.

31, 32 - Aphelecrinus bayensis (Meek & Worthen) - locality F-2E-1: anterior (A ray) view of a partial crown, X1, SUI 35507; and another partial crown with an abnormal second bifurcation of the left arm of the LPR, X1, SUI 35508.

33 - Aphelecrinus randolphensis (Worthen) - locality F-2E-1: posterior view of crown, X1, SUI 35510.

PLATE 15

Crinoidea, Blastoidea, Echinoidea

All figures are of silicified specimens except 17, 24, 39.

Figure

1, 2, 6, 7 - *Dichocrinus* aff. *D. huntsvillae* Wachsmuth & Springer - locality CH-3E-30: 1, 2, 7, anterior, posterior, basal views of crushed dorsal cup, X2.5, 1072TX14. 6, interior of an isolated basal, X2.5, 1072TX15.

3, 8, 12, 13 - *Talarocrinus* aff. *T. symmetricus* Casseday & Lyon - 3, locality F-2W-1: basal view of dorsal cup, X2, 1087TX1. 8, 12, 13, locality CA-6EE-4: basal, anterior, internal views of partial dorsal cup and tegmen, X2, 1046TX7.

4, 5, 9-11 - *Talarocrinus* cf. *T. ovatus* Worthen - locality CH-3E-30: 4, 5, 9, basal, posterior, ventral views of partial dorsal cup, X2, 1072TX16. 10, 11, distal articular surface, lateral articular views of isolated radial plate, X2.5, 1072TX17.

14 - Echinoderm stem A - locality F-2E-2: lateral view, X1.5, 1080TX12.

15, 16, 21 - Echinoderm stem B - locality CH-3E-28: 15, 21, articular, lateral views, X1.5, 1071TX1. 16, lateral view, X1.5, 1071TX2.

PLATE 15


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17, 24 - Stiberostaurus aestimatus Moore & Jeffords - locality CA-6EE-3: articular view, X1.5; lateral view, X1, 1045TX5.

18, 26, 29 - Echinoderm stem C - locality F-2E-2: articular surface, X1.5, 1080TX13; lateral view, X1.5, 1080TX14; lateral view, X1.5, 1080TX15.

19, 20 - Echinoderm stem D - locality F-2E-2: articular view, X1.5; lateral view, X1, 1080TX16.

22, 23 - Echinoderm stem E - locality F-2E-2: articular surface, X1.5, 1080TX17; lateral view, X1.5, 1080TX18.

25, 28, 30, 35, 36 - Archaeocidaris sp. - 25, locality WA-3E-8: lateral view of part of an isolated spine, X2, 1063TX6. 28, 30, locality CH-3E-28: external, lateral profile views of interambulacral plate, X2, 1071TX3. 35, 36, locality WA-4E-23: external, lateral profile views of partial interambulacral plate, X2, 1061TX5.

27, 31-34, 37 - Pentremites spp. - 27, 32, locality CH-3E-30: summit, lateral views, X 1.5, 1072TX13. 31, 37, locality CA-6EE-4: summit, lateral views, X1.5, 1046TX6. 33, F-2W-3: lateral view of specimen with parts of brachioles preserved on ambulacrum at left, X2, 1088TX2. 34, locality F-2E-1: lateral view of fractured specimen with part of stem and brachioles preserved, X1.5, 1079TX17.

38, 39 - Hadroblastus sp. - 38, locality CH-3E-30: lateral view of poorly preserved specimen, X2.5, 1072TX12. 39, locality F-2E-3: baso-lateral view of crushed specimen in shale, X2, 1081TX24.

PLATE 16

Plants

Figure

1-4, 6, 8 - Lepidodendron cf. L. volkmannianum Sternberg - 1-4, locality F-1E-1: 1, impression of small axis flanked by the external molds of two Lyrogoniatites newsomi georgiensis Miller & Furnish in a siderite nodule, X1.25, 1089TX2. 2-4, impressions and petrifactions of small plant axes with the external mold of an unidentified rhynchonellid brachiopod in a siderite nodule, X1.25; enlargement of part of fig. 2, showing scalariform pitted tracheids, X5; enlargement of another part of figure 2, showing small Lepidodendron axis with leaves, X4.5, 1089TX3. 6, 8, locality F-1E-26: latex mold of nodule in figure 8, X1.75; mold of part of an axis in a siderite nodule, X0.8, 1095TX8.

5 - Lepidophloios sp. - locality F-2E-13: impression of part of an axis showing imbricate leaf attachment bases, X1, 1083TX1.

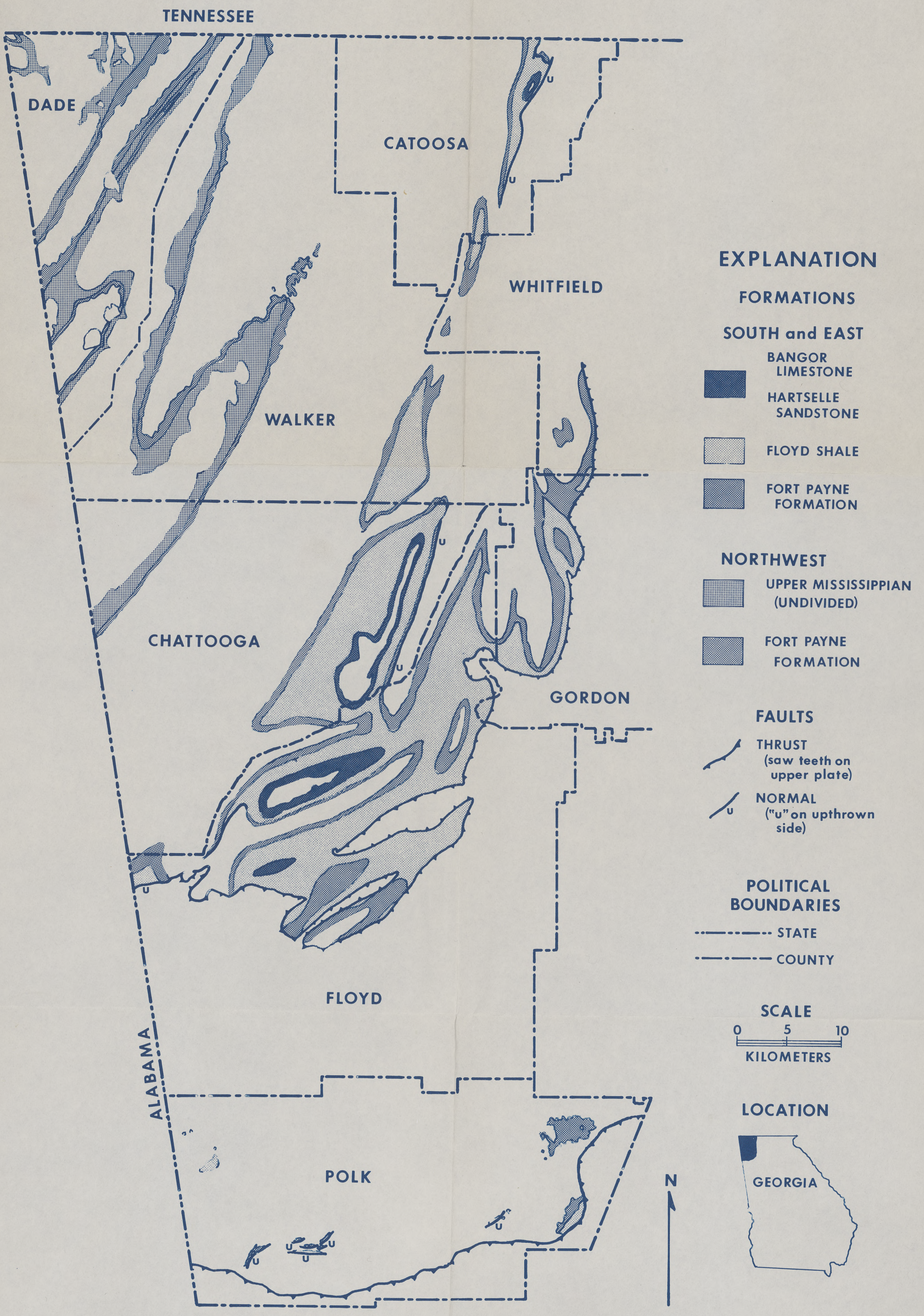
7 - Archaeocalamites sp. - locality F-1E-43: carbonized part of an axis, X2, 1098TX2.

9 - ?Archaeosigillaria sp. - locality CA-6EE-3: limestone block containing parts of several poorly carbonized axes, X0.8, 1045TX6.

PLATE 16

10 - Unidentified plant - locality F-2E-57: carbonized part of an axis with a knot at the top, X1, 1086TX1.

OUTCROP PATTERN OF MISSISSIPPIAN ROCKS IN NORTHWEST GEORGIA



Adapted from Croft, 1964; Cressler, 1963, 1964a, 1964b, 1970, 1974

PLATE 1

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