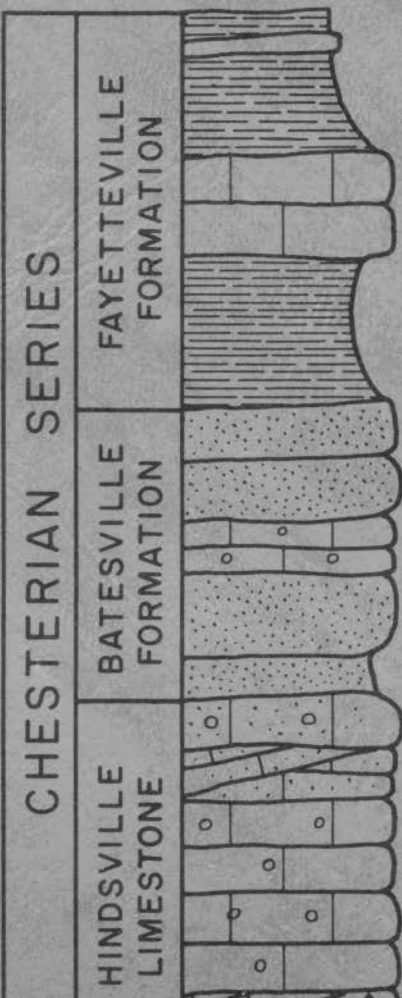
REPORT OF INVESTIGATIONS NUMBER 50

CONODONT BIOSTRATIGRAPHY OF CHESTERIAN STRATA IN SOUTHWESTERN MISSOURI



BY

THOMAS L. THOMPSON

Report of Investigations No. 50

1972

CONODONT BIOSTRATIGRAPHY OF CHESTERIAN STRATA IN SOUTHWESTERN MISSOURI

By Thomas L. Thompson

MISSOURI GEOLOGICAL SURVEY AND WATER RESOURCES
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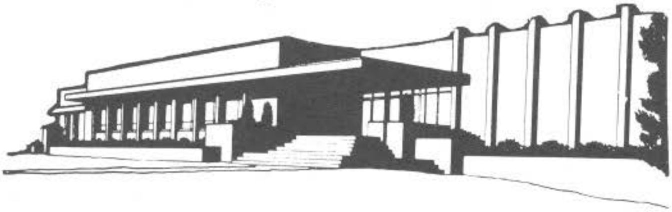

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ABSTRACT

The Hindsville Limestone and the Batesville, Fayetteville, and Carterville Formations of southwestern Missouri are correlated by conodonts with formations of the type Chesterian Series in southern Illinois, and with Chesterian strata in Texas, Arkansas, and Oklahoma. Of the 36 species of 14 genera and two unidentifiable species of two genera of conodonts recovered from 11 sections sampled, four species of four genera are discussed and illustrated, as is one unidentified species of one genus, and one new species of one genus, Ligonodina rexroadi *Thompson, n. sp.* Spathognathodus muricatus *(Dunn) was recovered from the Hindsville strata in Missouri, extending the range of this species to rocks older than previously reported.*

The Hindsville-Batesville conodont fauna represents the Gnathodus bilineatus-Cavusgnathus altus *Zone, found in the Golconda Group in the type region. The Hindsville-Batesville strata also correlate with the Barnett Shale of Texas, the lower part of the Stanley Shale of Arkansas, and the Ahlosa and Delaware Creek Members of the Caney Shale of Oklahoma. The Fayetteville of Missouri represents only the lower part of the Arkansas Fayetteville, and contains the fauna of the* G. bilineatus-Kladognathus mehli *Zone, represented by the Glen Dean Formation in southern Illinois. The upper member of the Caney Shale (Sand Branch Member) and the lower part of the Goddard Shale of Oklahoma also correlate with Missouri Fayetteville strata. The upper Fayetteville and the Pitkin formation of Arkansas and Oklahoma, which span the* K. primus Kladognathus-C. naviculus *and* Adetognathus unicornis *Zones, correlate with the Tar Springs-Waltersburg and Menard-Grove Church formations, respectively, in Illinois. The Carterville Formation appears to comprise scattered outliers of Hindsville lithology, deposited in irregularities or depressions on earlier strata, preserved partly because of this and partly through faulting.*

Results of this study indicate that the Chesterian conodonts of southwestern Missouri belong to the southern conodont province, and are more closely allied to Chesterian conodonts in Texas, Arkansas, and Oklahoma than to those in the type Chesterian strata of southern Illinois and eastern Missouri. In fact, correlation from southwestern into southeastern Missouri-southern Illinois is very difficult, whereas that of southwestern Missouri to Texas, Arkansas, and Oklahoma is much more precise.

† † † † †

INTRODUCTION

The Chesterian Series in southwestern Missouri consists of four formations (Spreng, 1961), including (in ascending order) the Hindsville Limestone and the Batesville and Fayetteville Formations (fig. 1). The fourth unit, the Carterville Formation, cannot be placed with accuracy within this stratigraphic sequence.

Chesterian outcrops in Barry County, Missouri (fig. 1, secs. 1-3) are northern remnants of strata present in the Boston Mountains of northern Arkansas and northeastern Oklahoma, preserved at least in part by faulting. The southwestern Missouri sequence is similar to that in the Boston Mountains with the addition of the Pitkin Formation above the Fayetteville. In northeastern Oklahoma and northern Arkansas, the Moorefield Formation, lying beneath the Hindsville, is considered by ammonoid specialists (see Furnish and Saunders, 1971) to be Chesterian in age. The typical *Goniatites* faunas, previously thought to be Meramecian in age were found to be early Chesterian by Moore (1937, 1948).

Cephalopods recovered from Chesterian strata of Arkansas and Oklahoma have been described in several reports, particularly by Quinn (1962); Furnish, Quinn, and McCaleb (1964); McCaleb, Quinn, and Furnish (1964); and Gordon (1965). Chesterian strata of southern Illinois (see fig. 5), the type region for the Chesterian Series, have been zoned on the basis of conodonts by Rexroad and Collinson (1961) and Collinson, Scott, and Rexroad (1962). This zonation was based on faunal descriptions published by Cooper (1947), Rexroad (1957), 1958), Rexroad and Burton (1961), Rexroad and Jarrell (1961), Rexroad and Liebe (1962), and Rexroad and Nicoll (1965) and has been recently revised by Collinson, Rexroad, and Thompson (1971). The megafauna of the southwestern Missouri Chesterian sequence was described by Wright (1952), who attempted

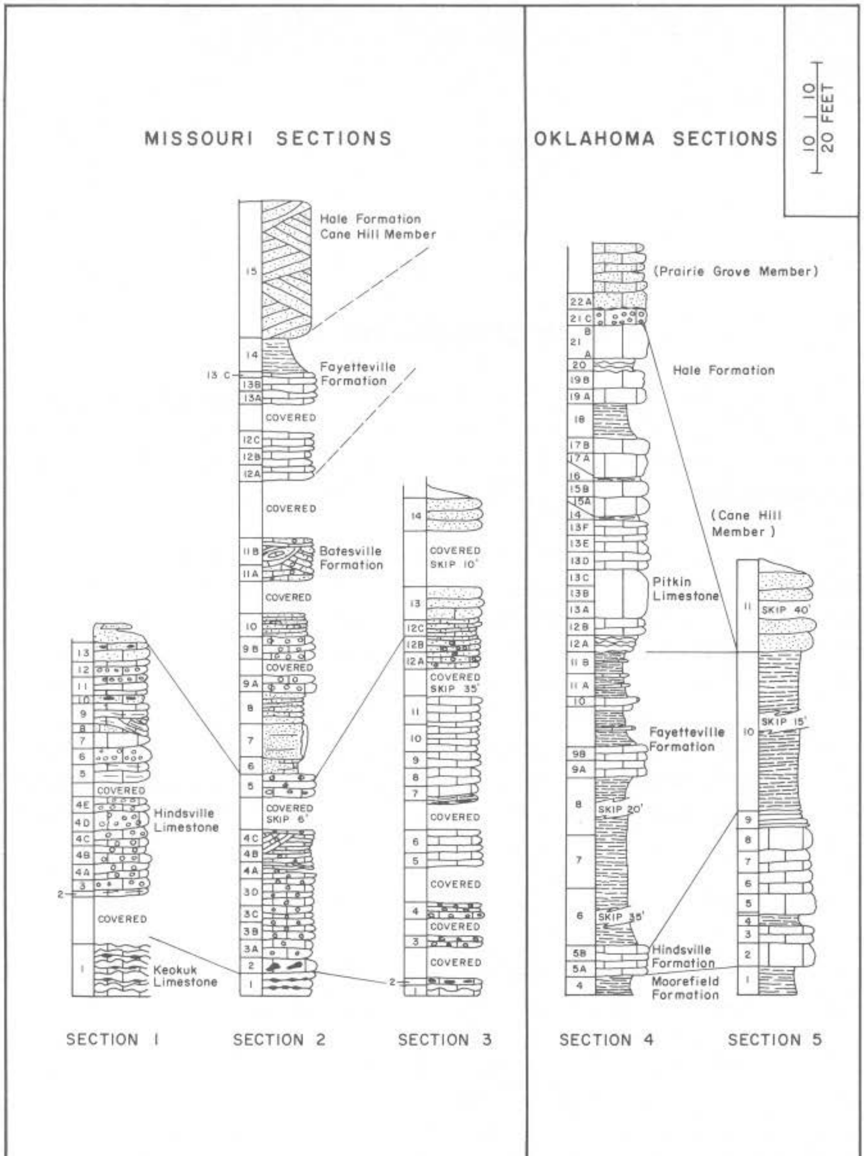
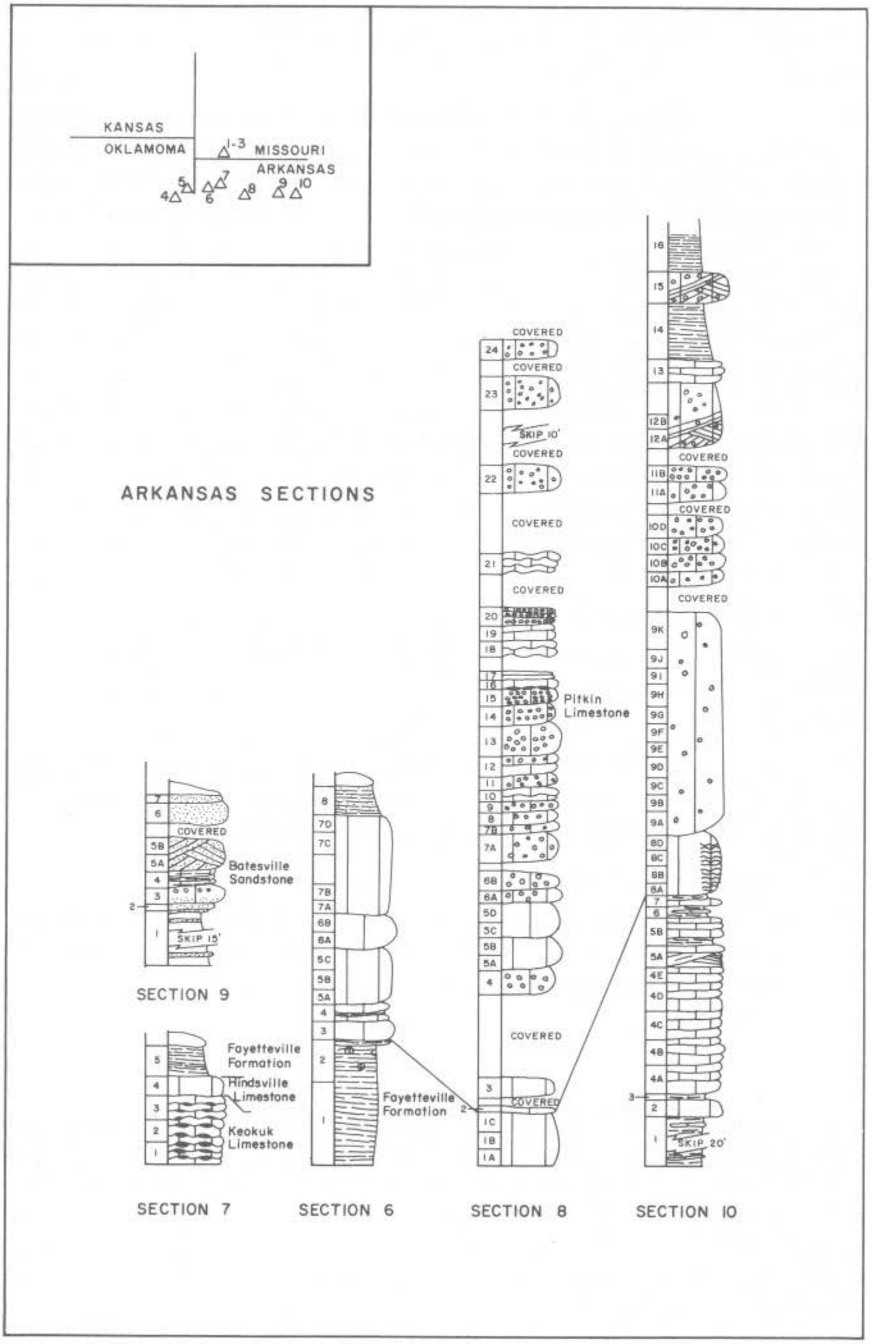


Figure 1

Stratigraphic columns of measured and sampled Chesterian sections 1-10. Sample numbers appear along the left edges of each column. Insert map shows relative location of each section.


KANSAS
OKLAMOMA
MISSOURI
ARKANSAS
ARKANSAS SECTIONS
COVERED
SKIP 10'
Pitkin Limestone
Batesville Sandstone
SKIP 15'
SECTION 9
Fayetteville Formation
Hindsville Limestone
Keokuk Limestone
Fayetteville Formation
SKIP 20'
SECTION 7
SECTION 6
SECTION 8
SECTION 10

to correlate this sequence with the standard Mississippian section. Bulow (1951) described a conodont fauna recovered from Hindsville and Fayetteville strata in southwestern Missouri, and concluded that there is (p.15) ". . .a close relationship between the Caney of Oklahoma and the Chester beds of southwestern Missouri, northwestern Arkansas and northeastern Oklahoma." Conodont faunas of Chesterian age were reported by Hass (1950) from the lower part of the Stanley Shale in Arkansas; Roundy (1926) and Hass (1953) from the Barnett Shale of Texas; and Elias (1956, 1966) from the Caney Shale and lower Goddard Shale of Oklahoma.

The purpose of this study is to describe the conodont fauna recovered from southwestern Missouri Chesterian rocks and to attempt to correlate these strata with Chesterian rocks of Arkansas, Oklahoma, and the type Chesterian region in southern Illinois. It was necessary to sample the equivalent strata in northern Arkansas and northeastern Oklahoma for this study, as no conodont faunal reports, save those of Lane (1967) and Dunn (1970b) for the Pitkin, have been previously published.

Sections described and sampled for this study are as follows (see fig. 1 for locality map):

1. **Washburn Quarry, ½-mile south of Washburn, 100 yards east of Highway 37;** NE SE sec. 33, T. 22 N., R. 28 W., Barry County, Missouri (Cassville 15-minute Quadrangle; MGS 1294-52) Hindsville Limestone.

2. **Oakleigh Mountain south;** NW NE sec. 7, T. 21 N., R. 28 W., Barry County, Missouri; stop 6 (p.58) of Clark and Beveridge (1952) (Cassville 15-minute Quadrangle; MGS 1294-66) Hindsville, Batesville, and Fayetteville formations.

3. **Washburn west, roadcut south side Missouri Highway 90, near north end of Oakleigh Mountain;** center north line sec. 32, T. 22 N., R. 28 W., Barry County, Missouri (Cassville 15-minute Quadrangle; MGS 1294-81) Hindsville and Batesville formations.

4. **Braggs Mountain, 10 miles east of Muskogee, roadcut on Oklahoma Highway 10;** SW sec. 21, T. 15 N., R. 20 E., Muskogee County, Oklahoma; locality 43 of Huffman, 1958; figure 3 of Quinn, 1966; locality 3 of Dunn, 1970a (MGS 1294-54) Hindsville, Fayetteville and Pitkin formations.

5. **Spade Mountain outlier, roadcut south side Oklahoma Highway 51, 5 miles northwest of Stilwell;** SE NE sec. 14, T. 16 N., R. 24 E., Adair County, Oklahoma; locality 92 of Huffman, 1958 (MGS 1294-59). Hindsville and Fayetteville formations.

6. **Type section Pitkin Formation (Easton, 1942, p.34), bluff and quarry east of U.S. Highway 71;** SE sec. 5 and SE SE SE sec. 16, T. 14 N., R. 30 W., Washington County, Arkansas; section 5 of Easton, 1942 (MGS 1294-61) Fayetteville and Pitkin formations.

7. **Elkins, roadcut on Arkansas Highway 74, ¼-mile east of White River bridge;** SE SE NE sec. 26, T. 16 N., R. 29 W., Washington County, Arkansas (MGS 1294-64) Hindsville Limestone.

8. **Red Rock Road (McElroy Gap), ½-mile east of Arkansas Highway 7 on gravel road;** NE sec. 35, T. 15 N., R. 21 W., Newton County, Arkansas; section 10 of Easton, 1942 (Mt. Judea 15-minute Quadrangle; MGS 1294-69) Pitkin Formation.

9. **Alco, valley wall and roadcut along Arkansas Highway 66 at small bridge;** NE NE NW sec. 5, T. 14 N., R. 13 W., Stone County, Arkansas (Mt. View 30-minute Quadrangle; MGS 1294-77) Batesville Formation.

10. **Mountain View south, roadcut east side Arkansas Highway 9, 1 mile south of Mountain View;** NE NW sec. 14, T. 14 N., R. 11 W., Stone County, Arkansas; section 19 of Easton, 1942 (Mt. View 30-minute Quadrangle; MGS 1294-78) Fayetteville and Pitkin formations.

11. **Pickerel Creek, roadcut north side of black top road just east of bridge over Pickerel Creek;** center south line SW SW sec. 2, T. 28 N., R. 24 W., Greene County, Missouri (Halltown 15-minute Quadrangle; MGS 1314-54) Carterville Formation.

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STRATIGRAPHY

HINDSVILLE LIMESTONE

The Hindsville Limestone was named by Purdue and Miser (1916) from exposures near Hindsville in Madison County, Arkansas. Garner (1967) considered the Hindsville to represent only (p.1236) ". . . accumulations of reef and biostromal limestone plus inter-reef sandy and shaly limestone . . . repeated scores of times (both vertically and laterally) across north Arkansas . . ., where shale and sandstone are regionally dominant." Ogren (1968) considered the boundary with the overlying Batesville Sandstone as arbitrary, and stated (p. 286) "The term 'Hindsville Formation' is used where more than 50 percent of the formation is limestone, and the term 'Batesville Sandstone' is used where more than 50 percent of the formation is sandstone." He believed that the Hindsville is a northern and western equivalent (shelf facies) of the Batesville sandstone to the south.

The Hindsville in southwestern Missouri consists of medium- to finely-crystalline limestone, generally oolitic and arenaceous, and commonly cross-stratified. The top at section 1 contains angular chert fragments and the base at sections 2 and 3 is conglomeratic (fig. 1). Glauconite is common, and residues usually contain some sand-sized euhedral quartz. The Hindsville appears to be variable in thickness within the area of exposure in Barry County. In some places the Batesville rests directly on the Keokuk Limestone. The Hindsville rests on Osagean (Boone) strata (Keokuk Limestone in Missouri) over most of its extent. In parts of northeastern Oklahoma the Hindsville rests on Moorefield strata of late Meramecian or early Chesterian age.

Weller, and others (1948) correlated the Hindsville of the Ozark region (Missouri and Arkansas) with the Renault and Bethel formations of the type Chesterian. Swann (1963) stated (p.31) that the ". . . boundary between the Valmeyeran and Chesterian . . . passes through the Renault." Wright (1952) suggested, primarily on the basis of brachiopods (p.45) ". . . that the Hindsville formation should be correlated with the Ste. Genevieve formation at the type section." Spreng (1961), discussing the Hindsville, stated (p.77) "The fauna shows some similarities to the fauna of the Ste. Genevieve formation (Meramecian), but it is also very similar to the Chester fauna of overlying formations. The formation has generally been regarded as lower Chesterian in age." Croneis (1930) had correlated the lower part of the Batesville in Arkansas with the Ste. Genevieve and the remainder with the Aux Vases-Bethel.

BATESVILLE FORMATION

The name Batesville was proposed separately by Penrose (1891) and Simonds (1891) for entirely different units. The Batesville formation proposed by Simonds was later (Adams and Ulrich, 1904) found to be a sandstone member (Wedington) of the Fayetteville Formation. Williams (1900) designated the type locality of the Batesville Formation as 1½ miles southeast of Batesville, Independence County, Arkansas. The Batesville appears to become progressively more calcareous, containing more limestone beds and lenses, westward from the type area, the Hindsville Limestone (or Limestone Member) recognized as a facies of the lower part in the western part of its extent. Only the Hindsville is present in some areas of western Arkansas and eastern Oklahoma (sections 5 and 7, fig. 1).

Girty (1915), in his report on the fauna of the Batesville sandstone of northern Arkansas, stated (p.17) that ". . . in 1898 Professor Weller stated his belief that it was definitely established on paleontological and stratigraphic evidence that the Batesville sandstone was the equivalent of the 'Aux Vases' (Cypress) sandstone of southern Illinois and southeastern Missouri. E.O. Ulrich [1905] on the other hand has suggested that the Batesville sandstone is really contemporaneous with the Cypress sandstone together with the underlying Ste.

Genevieve limestone." Girty (1915) stated (p.25) "On the whole, the evidence at hand seems to favor a correlation of the Batesville sandstone with the Cypress sandstone together with the upper part or possibly the whole of the Ste. Genevieve Limestone." The "Cypress" sandstone of Girty is today called Aux Vases. The present-day Cypress is not the Cypress of earlier classifications. Croneis (1930) considered the Batesville to correlate with the Ste. Genevieve-Paint Creek sequence. Weller, and others (1948) correlated the Batesville of southwestern Missouri with the Paint Creek of the type region. Wright (1952) stated (p.48) that the results of his study ". . . indicate that the Batesville formation of southwestern Missouri is equivalent to the Aux Vases, Renault, Bethel, Paint Creek, and Cypress formations of the type section."

FAYETTEVILLE FORMATION

The Fayetteville Formation in Arkansas is predominantly black, fissile, calcareous shale, as much as 350 feet thick. The upper part is sublithographic black limestone in the eastern part of its outcrop around Mountain View (section 10, fig. 1), considered by Quinn (1966) to represent the central portion of a massive reef complex. A sandstone member (Wedington) is recognized in the middle of the formation around the type area of the Fayetteville in Washington County, Arkansas, separating two thick shale units. That part of the Fayetteville exposed in Missouri was considered by Spreng (1961) to represent only the lower part of the Arkansas section.

In Missouri the Fayetteville consists of limestone and shale that conformably overlie limestone and sandy limestone of the Batesville Formation, differing from the gray to brown older unit in being dark gray to black in color. It is disconformably overlain by the Cane Hill Sandstone Member of the Hale Formation, a massive, cross-stratified non-marine sandstone of early Pennsylvanian (Morrowan) age. This sandstone is conspicuous in the area, as it forms the cap for the Boston Mountain outliers in Missouri.

At section 2 in Barry County, Missouri (fig. 1), the Fayetteville consists of fine- to medium-crystalline gray to black limestone overlain by sub-lithographic to finely-crystalline black limestone containing conspicuous large white productid brachiopods identified by Wright (1952) as *Linoproductus, Productus, Dictyoclostus, and Buxtonia.* About 6 feet of black, fissile shale overlies the limestone sequence.

Snider (1915) considered the Fayetteville and Pitkin to be equivalent to the Okaw (Golconda-Glen Dean) and Menard Limestones of the type region in southern Illinois. Croneis (1930) correlated the Fayetteville of Arkansas with the Paint Creek-Vienna sequence of the type section. Weller and others (1948) correlated the Fayetteville exposed in Missouri with the Cypress-Glen Dean of the type region, while the upper part of the Fayetteville in Arkansas was considered as young as Menard. Wright (1952) thought that a Golconda-Glen Dean age for the Missouri Fayetteville was likely, and Spreng (1961) agreed.

PITKIN FORMATION

The Pitkin Formation has not been recognized in Missouri, but is exposed in northern Arkansas and northeastern Oklahoma. This unit is predominantly limestone, although in the region around Mountain View, where it reaches its maximum thickness of around 400 feet (Easton, 1942), the upper part consists of shale and limestone.

The basic lithology of the Pitkin, as exposed at the type section in Washington County, Arkansas (sec. 6, fig. 1), is dense limestone containing oolites, crinoid and bryozoan debris, and oncolites. The entire 50 feet is essentially one lithologic unit. Although the formation thickens eastward from the type section, the lower part remains remarkably uniform in thickness and is generally very finely crystalline and oolitic, with a small amount of very fine euhedral quartz comprising the residue. The limestone of the upper shaly part is generally very coarsely crystalline and dark gray and differs from the single finely-crystalline massive unit of the lower part. Thick shales separate several 5- to 10-foot coarsely crystalline limestone beds. Barnes (1960) applied the

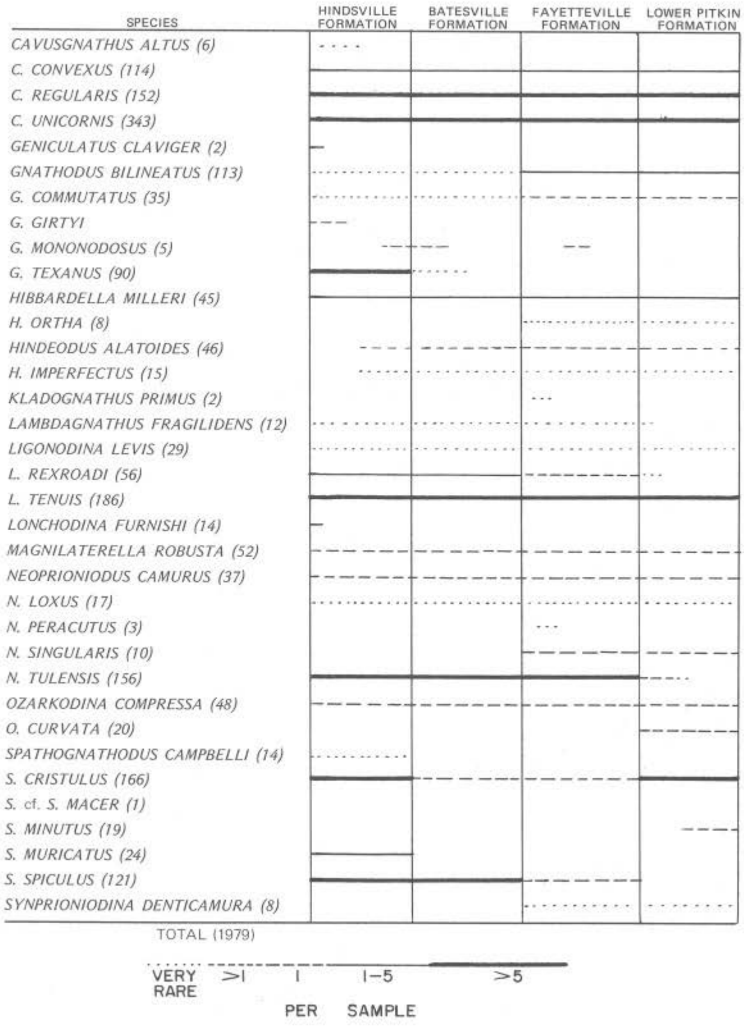

Figure 2

Range chart of conodont species recovered from Chesterian strata in southwestern Missouri. Ranges are local, and do not necessarily reflect total ranges. The number of specimens recovered is listed after each specific name.

name Marcella to this upper part; this same unit was named Imo by Gordon (1965). The upper part is not exposed at the type section where the basal Pennsylvanian Cane Hill Sandstone Member of the Hale Formation rests directly on the lower massive limestone.

Snider (1915) considered the Fayetteville-Pitkin sequence to be equivalent to the Okaw and Menard Limestones of the Mississippi Valley. Croneis (1930) correlated the Pitkin with the Waltersburg-Kinkaid sequence, whereas Easton (1942) considered it to be a correlative with the Clore-post-Kinkaid Mississippian sequence.

CARTERVILLE FORMATION

The Carterville Formation is present only in Jasper, Newton, Greene, and Lawrence Counties, Missouri, where it is found associated with local sink-fill

Table 1

Conodont species recovered from section 1, Washburn Quarry (1294-52)

	HINDSVILLE LIMESTONE															
SPECIES / SAMPLES	2	3	4A	4B	4C	4D	4E	5	6	7	8	9	10	11	12	13
CAVUSGNATHUS ALTUS				3												
C. CONVEXUS	1	3	1						2						1	1
C. REGULARIS		3	1		1	3	2		2					4		3
C. UNICORNIS	8	2	2	2	1	2	4		2			1		3	1	
GNATHODUS BILINEATUS																5
G. COMMUTATUS		1		1												
G. GIRTYI		2	1													
G. TEXANUS				28	2	3									3	14
HIBBARDELLA MILLERI				2					1	2	1	1				
HINDEODUS ALATOIDES													1			
H. IMPERFECTUS												1				
LIGONODINA LEVIS					1	1	1									
L. REXROADI				9	2		1							2		5
L. TENUIS				7	1		4		6	1	2	5	1	5		4
LONCHODINA sp. indet.	1	4	1	2	1	1	1	1	1	1	1	1	1	1	2	2
MAGNILATERELLA ROBUSTA				3			1							6	1	3
NEOPRIONIODUS LOXUS									1							
N. TULENSIS	1	1	1	11		1	2	1	4	2		1	1	2	2	10
OZARKODINA COMPRESSA	1				1				3						1	
SPATHOGNATHODUS CAMPBELLI				3		1							1	2	1	2
S. CRISTULUS	1	1							1			1		2		
S. MURICATUS	1	10	3	3											1	5
S. SPICULUS						2	1		1							2
S. sp.			1													

Table 2

Conodont species recovered from section 2, Oakleigh Mountain south (1294-66).

	HINDSVILLE LIMESTONE									BATESVILLE FORMATION									FAYETTEVILLE FORMATION						
SPECIES / SAMPLES	2	3A	3B	3C	3D	4A	4B	4C	5	6	7	8A	8B	9A	9B	10	11A	11B	12A	12B	12C	13A	13B	13C	14
APATOGNATHUS sp.								1																	
CAVUSGNATHUS CONVEXUS							1	1	1										1	3					
C. REGULARIS		2		1	3	3	2	2	1					1		1					1		1		
C. UNICORNIS	1	2		3	3		17	4					1	1						1	2	1			
GNATHODUS BILINEATUS	1																		19	8		5	9	2	
G. COMMUTATUS																					3	5			
G. GIRTYI		6																							
G. MONONODOSUS																					2				
G. TEXANUS				1	2	1	3	1		1						1									
HIBBARDELLA MILLERI		2				1	1	1							1					1	1				
H. ORTHA																			2	1					
HINDEODUS ALATOIDES								3														1			
H. IMPERFECTUS																			1						
LAMBDAGNATHUS FRAGILIDENS		1			1																				
LIGONODINA LEVIS		2			1		1															2			
L. REXROADI			1		2		3	1	1					2						1					
L. TENUIS	1	5	1	1				4	4	1				1					3	4	2				
LONCHODINA sp. indet.	1		1																						
MAGNILATERELLA ROBUSTA		2																				1			
NEOPRIONIODUS CAMURUS																			3						
N. LOXUS							1														1				
N. PERACUTUS																			1				1		
N. SINGULARIS																			1	1					
N. TULENSIS		4		2	2	3	5	3	5	1				2	1		1		3	3	5	6	1	1	
OZARKODINA COMPRESSA	1				2									1									2		
SPATHOGNATHODUS CAMPBELLI		1	1				2																		
S. CRISTULUS					2	2	5	4		1															
S. cf. *S. MACER*									1																
S. MURICATUS	1																								
S. SPICULUS							2	1						2	1				5	5	1	1	1		

Table 3

Conodont species recovered from section 3, Washburn west (1294-81).

SPECIES		HINDSVILLE LIMESTONE										FAYETTEVILLE FORMATION			
SPECIES	SAMPLES	2	3	4	5	6	7	8	9	10	11	12A	12B	12C	13
CAVUSGNATHUS CONVEXUS										1					
C. REGULARIS		3			1	2		4	3	1				1	
C. UNICORNIS		2						5	1	2	1				
GENICULATIS CLAVIGER		2													
GNATHODUS BILINEATUS		6													
G. COMMUTATUS		1	1												
G. TEXANUS		11							1						
HIBBARDELLA MILLERI		4				1	2	1	2	1	1				
HINDEODUS ALATOIDES									1	2					
H. IMPERFECTUS								1							
LAMBDAGNATHUS FRAGILIDENS		2							1	1					
LIGONODINA LEVIS		4		1	4			1	2		2				1
L. REXROADI		2					1		1		2				
L. TENUIS		8						7		2					
LONCHODINA FURNISHI		12													
MAGNILATERELLA ROBUSTA		2						3		2	1				
METALONCHODINA sp.		1													
NEOPRIONIODUS CAMURUS										1	1				
N. LOXUS										1					
N. SINGULARIS													1		
N. TULENSIS		12			1		2	2	4	1	3		1		
OZARKODINA COMPRESSA								2	1		1	1			
SPATHOGNATHODUS CRISTULUS		2							4	3	5				
S. MURICATUS		1													
S. SPICULUS								6	2	3	2				

deposits in older Mississippian rocks. It consists of oolitic limestone boulders within a clay or shale matrix, the whole being conglomeratic in nature. Spreng (1961, p.77) stated that the calcareous portion yielded the brachiopod *Spirifer increbescens* and the bryozoan *Archimedes,* and is Chesterian in age. The physical relationship of the Carterville to the Hindsville-Fayetteville sequence to the south is not clearly understood.

CONODONT FAUNA

The majority of conodont form-species recovered appear to be ubiquitous to the entire Hindsville-Pitkin sequence. Those that appear to be time-significant are discussed in the following section. Figure 2 is a local range chart of Chesterian conodont species recovered. Tables 1 to 3 list those conodont species recovered from the Missouri sections 1 to 3 by horizon sampled. Tables 4 to 10 list conodont species recovered from the seven Arkansas and Oklahoma sections sampled.

Cavusgnathus has little or no stratigraphic significance in the sequence studied. *Gnathodus bilineatus* Roundy is more abundant in the Fayetteville and Pitkin, although it is present in the Hindsville at all three Missouri sections, albeit in one sample only at each section. *G. commutatus* (Branson and Mehl) is distributed like *G. bilineatus,* present but rare in the Hindsville, more abundant in the Fayetteville and Pitkin (sections 2,4, and 10), although not abundant in any unit. The eight specimens of *G. mononodosus* Rhodes, Austin, and Druce were recovered from the Hindsville (section 1), Batesville (section 9), and Fayetteville (section 2), but this species' range in North America is not well-defined at this time.

Species essentially restricted to Hindsville strata include *Gnathodus girtyi* Hass, *G. texanus* Roundy, *Spathognathodus campbelli* Rexroad, and *S. muricatus* (Dunn). Of the 90 specimens of *G. texanus* recovered, all but seven were from the Hindsville (sections 1 to 5), the remaining seven from the Batesville (sections 2 and 9). *G. girtyi* is restricted to only the basal few samples of the Hindsville.

Ligonodina rexroadi Thompson, n. sp. is present throughout the sequence, but is more common in the Hindsville and Batesville. The occurrences of *S. spiculus* Youngquist and Miller appear to be Hindsville through Fayetteville. *Ozarkodina curvata* Rexroad and *S. minutus* (Ellison) are restricted to the Pitkin (sections 4, 6, 8, and 10) and were not recovered from the Missouri sections. *Neoprioniodus singularis* (Hass) was not recovered below the Fayetteville.

Table 4

Conodont species recovered from section 4, Braggs Mountain, Oklahoma (1294-54).

	HINDSVILLE LIMESTONE		FAYETTEVILLE FORMATION						PITKIN FORMATION																		HALE FORMATION
SPECIES / SAMPLES	5A	5B	8	9A	9B	10	11A	11B	12A	12B	13A	13B	13C	13D	13E	13F	15A	15B	17A	17B	19A	19B	20	21A	21B	21C	22A
ADETOGNATHUS GIGANTUS																											4
A. LAUTUS																											4
CAVUSGNATHUS CONVEXUS	6	1		1	1			1		6	1		1	1	10	1	4	1	2			1	2	2		1	
C. REGULARIS	4			3	7			1		5	2		2		1		1	1	3		2		2			1	
C. UNICORNIS	4			14	14					5	6		3	1	27	3	2	4	5	3	4	1	2	4	1	6	
GNATHODUS BILINEATUS	1			1	1		13	1		1	1				1	1							2	1	1	1	
G. COMMUTATUS				2	1		2																				
G. TEXANUS	5																										
HIBBARDELLA MILLERI	3																										
H. ORTHA					1									1													
HINDEODUS ALATOIDES																							3	1			
H. IMPERFECTUS															1								1				
IDIOGNATHOIDES NODULIFERUS																											3
I. SINUATUS																											1
KLADOGNATHUS PRIMUS				1	1																						
LAMBDAGNATHUS FRAGILIDENS		2																									
LIGONODINA LEVIS	2																										
L. REXROADI	2				2																						
L. TENUIS	10	4		2	2																						
LONCHODINA sp. indet.					1					1																2	
MAGNILATERELLA ROBUSTA	8	4		1	2																						
NEOPRIONIODUS CAMURUS	3	1		1				1																			
N. LOXUS										1					1	1	1										
N. PERACUTUS				1																							
N. TULENSIS	15	1		6	6																						
OZARKODINA COMPRESSA		1			2										1				1			1	1		1		
O. CURVATA																							2	2			
SPATHOGNATHODUS CRISTULUS						1				2			1		8	1	2		1		1		1	2	3		
S. MINUTUS																									1		
S. SPICULUS	31	2		1			3																				
SYNPRIONIODINA DENTICAMURA				1	1																						

Table 5

Conodont species recovered from section 5, Spade Mountain outlier, Oklahoma (1294-59).

SPECIES	SAMPLES	HINDSVILLE LIMESTONE 2	3	5	6	7	8	FAYETTEVILLE FORMATION 9
CAVUSGNATHUS ALTUS			3					
C. CONVEXUS			2			1		1
C. REGULARIS			3			1		
C. UNICORNIS		3	4		2	2	3	2
GNATHODUS BILINEATUS			1					
G. COMMUTATUS							1	
G. TEXANUS		5	2	1				
HIBBARDELLA MILLERI			8			1		
HINDEODUS ALATOIDES					1		1	1
LIGONODINA LEVIS							1	
L. REXROADI		3	6			1	2	
L. TENUIS		5	12		2		3	
LONCHODINA sp. indet.		2						
MAGNILATERELLA ROBUSTA			1	1	1	2	1	
NEOPRIONIODUS TULENSIS		6	11	2		1	3	3
OZARKODINA COMPRESSA					2	3		1
SPATHOGNATHODUS SPICULUS		1	1		3	9	4	7
SYNPRIONIODINA DENTICAMURA								1

Table 6

Conodont species recovered from section 6, type section Pitkin Formation (1294-61).

SPECIES	SAMPLES	FAYETTEVILLE FORMATION 2	PITKIN FORMATION 3	4	5A	5B	5C	6A	6B	7A	7B	7C	7D
CAVUSGNATHUS CONVEXUS				1			2	1	1				
C. REGULARIS				3					2	2		1	1
C. UNICORNIS			1	4	1		3			2	3	2	
GNATHODUS COMMUTATUS			1										
HIBBARDELLA MILLERI						1							
H. ORTHA									1				
HINDEODUS ALATOIDES					1		2		3				
H. IMPERFECTUS					1		1						
LIGONODINA LEVIS				1									
L. REXROADI				2					1				
L. TENUIS						1	2						1
LONCHODINA sp. indet.										2			
NEOPRIONIODUS CAMURUS				1	1		1				1	1	
N. LOXUS					1								
N. TULENSIS				1		1	2			1	3	1	
OZARKODINA COMPRESSA					1				1	1		1	
O. CURVATA							1				2		
SPATHOGNATHODUS CRISTULUS				1	4	8		3	2	2	4	1	5
S. MINUTUS										1	1		

SPECIES	SAMPLES	4A	4B
CAVUSGNATHUS CONVEXUS		1	
HIBBARDELLA MILLERI		2	
MAGNILATERELLA ROBUSTA		1	
NEOPRIONIODUS TULENSIS		1	
SPATHOGNATHODUS SPICULUS		4	3

Table 7

Conodont species recovered from the Hindsville Limestone at section 7, Elkins, Arkansas (1294-64).

Table 8

Conodont species recovered from the Pitkin Formation at section 8, Red Rock Road, Arkansas (1294-69).

PITKIN FORMATION

SPECIES / SAMPLES	1A	1B	1C	2	3	4	5A	5B	5C	5D	6A	6B	7A	7B	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
CAVUSGNATHUS CONVEXUS	1	1		1						2			1	2	2		1	1			1	1	3	2	2	2	2		2	2	1
C. REGULARIS	2	1			2	2		1		3	1			2	3	1					1	1	1	2	3	2	8				
C. UNICORNIS		1	1	3		4	2	1	8	12			1	3	2		5	3		4	3		6	2	7	3	12		3	5	1
GENICULATUS sp.											1																				
GNATHODUS BILINEATUS																		3						10			1				
G. COMMUTATUS				1			1																	1	1						
HINDEODUS ALATOIDES												1					4	1					2	6			1				
H. IMPERFECTUS						1																	1								
LAMBDAGNATHUS FRAGILIDENS										1																					
LIGONODINA REXROADI				1																											
L. TENUIS				3		1			1	1																					
MAGNILATERELLA ROBUSTA				2					1																						
NEOPRIONIODUS CAMURUS															3	2	2	2					2	2	1						
N. LOXUS																											1				
N. SINGULARIS				2	1													1						2							
N. TULENSIS			2	4	2	1		2	1																					6	
OZARKODINA COMPRESSA		2			2																		1								
O. CURVATA					1												2						1	5							
SPATHOGNATHODUS CRISTULUS		1	1			1		2		1		1	4	1		1	3	3	3		5	1	11	3	4	3	4				
S. MINUTUS				1													2	5						6							
SYNPRIONIODINA DENTICAMURA				1																				2	1						

Table 9

Conodont species recovered from the Batesville Formation at section 9, Alco, Arkansas (1294-77).

SPECIES / SAMPLES	3	4	5A	5B	6	7
CAVUSGNATHUS UNICORNIS	2					
GNATHODUS BILINEATUS	2					
G. COMMUTATUS	1					
G. MONONODOSUS	2					
G. TEXANUS			4		1	
HIBBARDELLA MILLERI	1					
LIGONODINA REXROADI	1					
L. TENUIS	4					
MAGNILATERELLA ROBUSTA	3		1			
NEOPRIONIODUS TULENSIS	2					

Table 10

Conodont species recovered from section 10, Mountain View south, Arkansas.

	FAYETTEVILLE FORMATION								PITKIN FORMATION																								
SPECIES / SAMPLES	4A	4B	4C	4D	4E	5A	5B	7	8A	8B	8C	8D	9A	9B	9C	9D	9E	9F	9G	9H	9I	9J	9K	10A	10B	10C	10D	11A	11B	12A	12B	13	15
CAVUSGNATHUS CONVEXUS		2									2		1	1	1			1				1		2						1			
C. REGULARIS	1			1		1			2						1	1				2	1		1	2		1			1				
C. UNICORNIS			1		1	1			2		2		2			3		2		4	2	1	1	10	2	3	1	1		3			
GNATHODUS BILINEATUS									6	1										2					1						1		
G. COMMUTATUS								1			1										1								2				
HIBBARDELLA MILLERI											1													1									
H. ORTHA		1								1																							
HINDEODELLA sp.	2	2	3		3						4				2									1									
HINDEODUS ALATOIDES		1	1		1	1			3	1	1										2												
H. IMPERFECTUS					1				1	1											1			1									
LAMBDAGNATHUS FRAGILIDENS													1																				
LIGONODINA LEVIS												1																					
L. TENUIS																													1				
NEOPRIONIODUS CAMURUS					1		1		1	2	1																			1			
N. LOXUS	1	1	1	1	1				1	1	1									2													
N. SINGULARIS															1										1								
N. TULENSIS																		1						1	1			1					
OZARKODINA COMPRESSA				2		1			4	3						1								1			1						
O. COMPRESSA RECTA											1										1										1		
O. CURVATA									1																								
SPATHOGNATHODUS CRISTULUS					2				5	1		2	1	2	1		1			3	1			4	3				2			1	1
S. MINUTUS			1		1																			1						1			
S. SPICULUS						3	4																										
SYNPRIONIODINA DENTICAMURA			1																														

Of special interest is the recovery of specimens of *Spathognathodus muricatus.* These specimens are separated from *Adetognathus* because the unit consists of a central carina-like blade and parallel parapet, not two laterally developed parapets. It is not here considered to be within *Rachistognathus* of Dunn (1966) because it has a well-developed median trough or separation between "carina" and parapet over most of the "platform", a character that Dunn (1966, p.1301), in the original definition of the genus, stated is ". . . lacking as are the median trough and marginal rims or parapets of *Cavusgnathus.*" Also, *Rachistognathus* possesses a discontinuous carina, whereas *Spathognathodus muricatus* has a continuous carina to the posterior end. It appears that all S. *muricatus* are left-sided. All *Cavusgnathus* are right-sided, and species of *Adetognathus* and *Idiognathoides* (or *Rachistognathus*) may be either, or both. Other double-row spathognathodids, such as *S. aculeatus* (Branson and Mehl) and *S. costatus* (Branson) are also left-sided (see Ziegler, 1962, pls. 13, 14).

CORRELATIONS

Correlation of Chesterian strata is complicated by the fact that two dissimilar conodont faunal sequences are known, that of the type Chesterian area of southern Illinois (fig. 3), and that of the Barnett and Caney Shales of

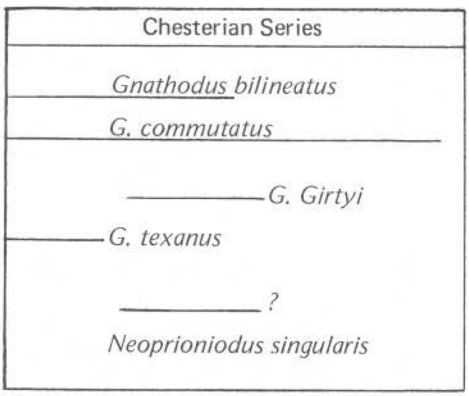

Figure 3

Relative ranges of important species of conodonts in the type Chesterian strata of southern Illinois. Data from Collinson, Rexroad, and Thompson (1971).

Texas and Oklahoma (fig. 4), called the "southern province" by Rexroad and Jarrell (1961). The same problem has existed in faunal comparisons of ammonoids between the type Chesterian and the southern Mid-continent (Furnish and Saunders, 1971). The fauna reported in this report more closely resembles that of the southern province, particularly in the differing ranges of *Gnathodus bilineatus, G. commutatus, G. girtyi,* and *G. texanus.*

Gnathodus girtyi is very restricted in the southern province and has been recovered only from the basal part of the Barnett Shale (Hass, 1953). *G. bilineatus* ranges throughout the Barnett and Caney Shales (Elias, 1956), and into the lower part of the Goddard Shale of Oklahoma. *G. commutatus* and *G. texanus* also span the Barnett, have been found in the basal Stanley Shale of Arkansas (Hass, 1950), and range up to the middle of the Caney Shale in Oklahoma.

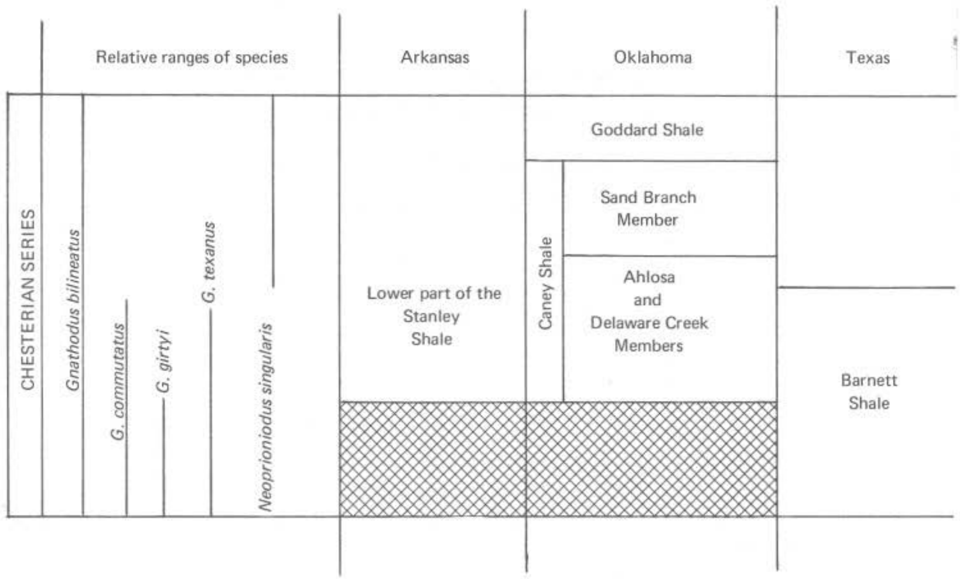

Figure 4

Biostratigraphic correlation of the Stanley Shale of Arkansas (Hass, 1950), the Barnett Shale of Texas (Hass, 1953), and the Caney Shale of Oklahoma (Elias, 1956); including the relative ranges of important conodont species within the southern conodont province.

The comparison of ranges of the species of *Gnathodus* in southern Illinois Chesterian strata with those of the southern province shows a reversal of *G. texanus* and *G. girtyi*, and restriction of *G. bilineatus* to the lower half of the Chesterian Series in the former region. *G. commutatus* ranges higher than *G. bilineatus.* Therefore, the major differences are the longer ranges of *G. bilineatus* and *G. texanus* in the southern province.

The following part of this report is an attempt to correlate southwestern Missouri Chesterian strata with named units of the type Chesterian region on one hand, and the strata of the southern conodont province on the other, realizing that the evidence may in some cases be inconclusive. The correlations presented below are illustrated in figure 5.

HINDSVILLE AND BATESVILLE FORMATIONS

Collinson, Rexroad, and Thompson (1971) indicated that *Gnathodus bilineatus* and *G. girtyi* range higher in the Chesterian of Nevada than in the southern Illinois region. It appears that *G. bilineatus* ranges higher in the southwestern Missouri-northern Arkansas region, but that *G. girtyi* does not, with the latter being restricted (along with *Spathognathodus campbelli* and *S. muricatus*) to the Hindsville Limestone. *Gnathodus girtyi* ranges higher than *G. texanus* in the type Chesterian area, but the latter is present throughout the Barnett Shale of Texas (Hass, 1953) while the former is restricted to the lower part (see fig. 4).

The Hindsville Limestone of southwestern Missouri appears to correlate with the lower part of the *G. bilineatus - Cavusgnathus altus* Zone of the southern Illinois type Chesterian. Since *G. texanus* ranges higher than *G. girtyi* in the southern province, the top of this zone is extended to include the youngest occurrence of *G. texanus.* In the type area, *G. texanus* occurs within this zone, but not above it (Collinson, Rexroad, and Thompson, 1971). However, the Hindsville conodont fauna is more representative of the southern conodont province. On this basis, the Hindsville Limestone correlates with the lower part of the Barnett Shale of Texas and probably with the Golconda Group of the type region in southern Illinois. Furnish and Saunders (1971, p.5), on the basis of ammonoids, correlate the Hindsville-Batesville with the Beech Creek Limestone.

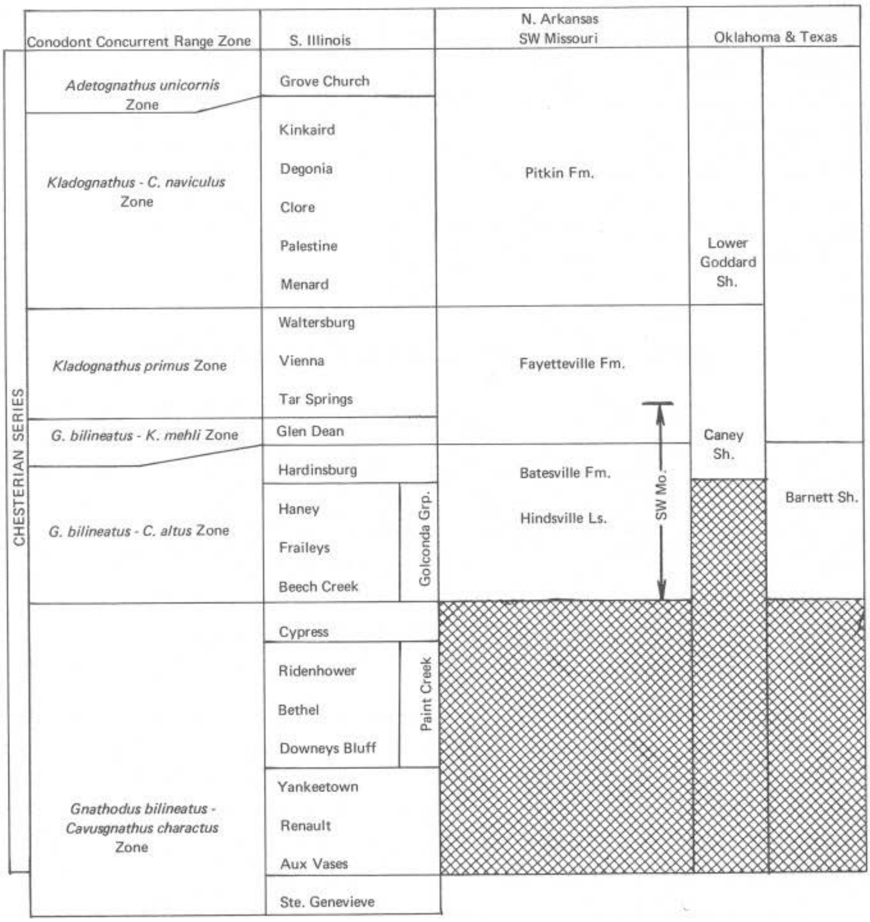

Figure 5

Correlation of Chesterian strata of southwestern Missouri, southern Illinois, Oklahoma and Texas based on conodonts. Zones are from Collinson, Rexroad, and Thompson (1971).

The Batesville Formation at sections 2 and 9 yielded *G. texanus* as the only significant form. According to the uppermost range of *G. texanus* from the southern Illinois region this would probably correlate with strata no younger than the Downeys Bluff Formation. However, an upper Golconda-Hardinsburg correlation, based on southern province characteristics, is more probable. The Hindsville-Batesville sequence appears to correlate (fig. 4) with the Barnett Shale of Texas, the basal Stanley Shale of Arkansas (Hass, 1950), and the Ahlosa and Delaware Creek Members of the Caney Shale of Oklahoma (Elias, 1956).

The presence of *S. muricatus* and *G. girtyi* indicates a correlation of the Hindsville with the upper part of the limestone from Core A of Thompson and Goebel (1961, p.46). Although correlated by them with the *Apatognathus scalenus - Cavusgnathus* Zone, characteristic of the St. Louis Limestone of late Meramecian age, this fauna now appears to be more similar to the lower part of the *G. bilineatus - C. altus* Zone. Therefore, the upper part of Core A of Thompson and Goebel (1961), the Mobil Oil Company No.1 Cunningham Estate core in Stevens County, Kansas (above 6790 feet) is most likely early Chesterian in age.

Branson and Mehl (1941) described and named *Spathognathodus commutatus* (now *Gnathodus commutatus*) from a limestone in Craig County, Oklahoma, reported by them (p.98) to be the "Pitkin limestone." The fauna from this locality (Branson and Mehl collection 1299, University of Missouri repository, Columbia) is identified by the author to contain:

Cavusgnathus altus (104)
C. charactus (11)
C. convexus (44)
C. regularis (24)
C. unicornis (28)
C. fragments *(118)*
Gnathodus bilineatus (104)
G. commutatus (87)
G. girtyi (1)
G. mononodosus (5)
G. texanus (276)
G. cf. *G. texanus (10)*
Hibbardella sp. *(4)*
Ligonodina rexroadi (21)
L. tenuis (9)
Lonchodina sp. *(4)*
Magnilaterella sp. *(21)*
Metalonchodina sp. *(2)*
Neoprioniodus ligo (2)
N. loxus (5)
N. tulensis (25)
Ozarkodina compressa (6)

R.L. Ethington (University of Missouri-Columbia, pers. comm., 1970) stated that a card placed by M.G. Mehl with collection 1299 states "About 8.2

miles SW of Afton, Oklahoma, along Highway 69. There is exposed in ditch along roadside a wide long area of highly crinoidal, irregular, thin-bedded limestone with small thicknesses of greenish shale (unctuous clay) between." A check of this location on county road maps of northeastern Oklahoma shows this section to be about at the center, south line SE sec. 21 (or center, north line NE sec. 28), T. 25 N., R. 21 E., Craig County, Oklahoma. This is now along U.S. Highways 60 and 66 (Highway 69 has apparently been relocated). The geologic map prepared by Huffman (1958, Plate 1) for this region indicates that the rock at this locality is identified as Hindsville Limestone. No Pitkin is reported anywhere in the vicinity of this location.

Elias (1956, p.116) also noted this erroneous "Pitkin" identification, but concluded that the collection must have been made from the Fayetteville Shale, which is also exposed in Craig County, Oklahoma. However, the crinoidal nature of the limestone collected would rule this out. H.L. Strimple (University of Iowa, Iowa City, pers. comm., 1970) supported the idea that there is no Pitkin in the vicinity of this locality and substantiates the probable Hindsville identification for this locality.

The fauna recovered from location 1299 by Branson and Mehl correlates closely with that recovered from the Hindsville Limestone elsewhere (see tbls. 4 and 5) in Oklahoma. Apparently the type locality of *Gnathodus commutatus*, located above, lies within the outcrop belt of the Hindsville Limestone (early Chesterian), not the Pitkin Limestone (late Chesterian) as originally stated by Branson and Mehl (1941).

FAYETTEVILLE FORMATION

The conodont fauna of the Fayetteville Formation indicates significant change from the underlying Batesville fauna, *G. bilineatus* and *G. commutatus* becoming prominent within the fauna (secs. 2 and 4). This fauna also contains the oldest *Neoprioniodus singularis* and the youngest *Spathognathodus spiculus* for the southwestern Missouri Chesterian sequence.

The Fayetteville appears to correlate with the Sand Branch Member of the Caney Shale (Elias, 1956) based on the presence of *N. singularis* and the absence of *G. girtyi* and *G. texanus*. The youngest Barnett Shale contains *G. texanus* (Hass, 1953) and, therefore, is slightly older than the oldest Fayetteville.

The Fayetteville appears to span the *G. bilineatus - Kladognathus mehli* and *K. primus* Zones (Collinson, Rexroad, and Thompson, 1971). Therefore, the Fayetteville Formation is correlated by conodonts with the southern Illinois Glen Dean through Waltersburg sequence (see fig. 5). Furnish and Saunders (1971, p.5) indicate the Fayetteville may be as old as middle Golconda. However, only the lower part, probably Glen Dean, is represented in Missouri. Upper Fayetteville strata in Arkansas show a decrease in *G. bilineatus* upward, and the complete disappearance of *S. spiculus* prior to Pitkin deposition.

PITKIN FORMATION

The only differences between Fayetteville and Pitkin conodonts (fig. 2) are the disappearance of *S. spiculus* at the top of the Fayetteville, the rare occurrence of *Ozarkodina curvata* throughout the Pitkin, and the only specimens of *S. minutus* from the upper part of the Pitkin.

The conodont fauna of the lower limestone of the Pitkin, as represented at sections 4, 8 and 10, does not correlate directly with any of the conodont zones established for the southern Illinois region. Lane (1967) correlated Pitkin conodonts exclusive of the *Adetognathus unicornis* Zone (*Streptognathodus unicornis* Zone of Collinson, Rexroad, and Thompson, 1971) with the Menard-Kinkaid formations. Uppermost Pitkin and younger Mississippian strata (Marcella, Imo) are, at least in part, equivalent to, and possibly younger than, the Grove Church Formation in Illinois (Lane 1967).

The presence of *G. commutatus* in the Pitkin above the highest *G. texanus*, extends the range of this species in the southern province to compare with that in the Mississippi Valley.

CARTERVILLE FORMATION

The Carterville Formation at section 11 yielded the following conodont species:

Cavusgnathus convexus (4)
C. unicornis (8)
Gnathodus bilineatus (1)
Hibbardella milleri (2)
Ligonodina levis (1)
L. rexroadi (5)
Magnilaterella robusts (2)
Neoprioniodus tulensis (5)
Ozarkodina compressa (1)
Spathognathodus spiculus (3)

The presence of *L. rexroadi* and *S. spiculus* suggests, from figure 2, a correlation of the Carterville with the middle portion of the Hindsville-Batesville sequence. It is possible, considering the lithologic similarities, that the Carterville is a Hindsville remnant.

CONCLUSIONS

Conodont faunas of the upper part of the Mississippian do not illustrate the rapid evolution shown by those in Kinderhookian and Osagean strata (Thompson and Fellows, 1970). Perhaps late Meramecian and Chesterian sediments were deposited more rapidly than those deposited earlier within the Mississippian System. The clastics introduced into late Meramecian (Ste. Genevieve) and younger rocks would suggest this.

Evidence indicates that the faunas of Chesterian strata of southwestern Missouri were more closely related to the southern conodont province than the Illinois basin. The fauna of the Hindsville Limestone, containing *S. muricatus,* is unlike any from the Illinois basin, but is similar to one recovered from western Kansas. The Beech Creek fauna of southern Illinois was regarded to represent the southern province (Rexroad and Jarrell, 1961). It appears that although relatively close to the southeastern Missouri - southern Illinois type region, the strata of the southwestern Missouri Chesterian sequence are difficult to correlate with the type region.

Based on the presence of *G. girtyi,* the Hindsville Limestone of southwestern Missouri correlates with the lower part of the Barnett Shale of Texas and probably the lower Golconda Group of southern Illinois. The Hindsville-Batesville sequence in southwestern Missouri appears to represent the *Gnathodus bilineatus - Cavusgnathus altus* Zone. As reported by Spreng (1961), the Fayetteville of Missouri represents only the lower part of the Arkansas Fayetteville, and lies within the *G. bilineatus - Kladognathus mehli* Zone, correlating apparently with the Glen Dean in southern Illinois and the upper part of the Caney Shale (Sand Branch Member) and possibly the lower Goddard Shale of Oklahoma.

The upper Fayetteville and Pitkin formations of Arkansas and Oklahoma represent the *K. primus, Kladognathus - C. naviculus,* and *Adetognathus unicornis* (or *Streptognathodus unicornis*) Zones, spanning the Tar Springs-Waltersburg (Fayetteville) and Menard-Grove Church (Pitkin) units of southern Illinois.

The Carterville Formation appears to consist of outliers of Hindsville lithology preserved in topographic lows, erosional depressions, and/or sink structures within underlying strata. Possibly this is due to faulting.

SYSTEMATIC PALEONTOLOGY

Only those conodont species are included that are new or require detailed discussion concerning nomenclature and/or identification. All figured specimens are reposited at the University of Missouri-Columbia (UMC).

Genus APATOGNATHUS Branson and Mehl, 1934

APATOGNATHUS sp.

Pl. 1, fig. 20

Description.— Unit highly arched, slightly bowed, with numerous closely spaced denticles of near equal length along both limbs.

Remarks.— Although fragmentary, this single specimen of *Apatognathus* is illustrated for possible future comparison.

Material studied.— One specimen from the Hindsville Limestone in Missouri (section 2).

Repository.— UMC 1023-10.

Genus GNATHODUS Pander, 1856

GNATHODUS COMMUTATUS (Branson and Mehl)

Pl. 1, figs. 6, 7.

Spathognathodus commutatus BRANSON and Mehl, 1941, p.98, pl. 19, figs. 1-4.

Gnathodus commutatus commutatus (Branson and Mehl), REYNOLDS, 1970, p. 7, pl. 1, figs. 7,9.

For complete synonomy and description see Webster (1969, p.31).

Remarks.— Specimens of *Gnathodus commutatus* (Branson and Mehl) recovered in this report have relatively elongate, narrow platforms. Those of Thompson and Goebel (1969, pl. 4, figs. 4, 6, 7) and many other workers are broader and more circular. The type locality for this species, located in Craig County, Oklahoma, was reported to be Pitkin limestone by Branson and Mehl (1941c). This exposure is now identified as Hindsville Limestone.

Occurrence.— *Gnathodus commutatus* has previously been recovered from rocks of late Meramecian through middle Chesterian age.

Material studied.— 35 specimens from the Hindsville (sections 1, 3, 5), Batesville (section 9), Fayetteville (sections 2,4) and Pitkin (sections 6, 8, 10) formations.

Repository.— UMC 1023-11.

GNATHODUS MONONODOSUS Rhodes, Austin, and Druce

Pl. 1, figs. 3-5.

Gnathodus commutatus var. *nodosus* HIGGINS (part), 1961, pl. 10, fig. 7 only, text-fig. 1b.

Gnathodus mononodosus RHODES, AUSTIN, and DRUCE, 1969, p. 103, pl. 19, figs. 13a-15d.

Diagnosis.— Straight to slightly curved blade with small sub-circular posterior platform bearing single node on inner side as only ornamentation.

Remarks.— The platform of *Gnathodus mononodosus* Rhodes, Austin, and Druce is subcircular and symmetrical, whereas that of *G. texanus* Roundy is distinctly asymmetrical. Both possess a single node or parapet as the only ornamentation, but the node of the former is small and circular, the node or parapet of the latter elongate parallel to the carina. *G. nodosus* Bischoff has a large, roughly elongate node on both sides of the carina, and the platform is generally wider than that of *G. mononodosus.* This species appears to be derived from *G. commutatus* Branson and Mehl by the addition of a single node on the platform. Whether this difference rates specific instead of subspecific rank is open to question.

Occurrence.— *Gnathodus mononodosus* has previously been recovered only from Great Britain, and the range chart of Rhodes, Austin, and Druce

(1969, fig. 52) indicates that it ranges from late Meramecian Ste. Genevieve (CYD7) to near the top of the lower Chesterian Bethel (3D19). This corresponds to the upper two-thirds of the *G. bilineatus - Cavusgnathus altus* Zone of the Mississippi Valley.

Material studied.— Eight specimens recovered from the Hindsville (section 1), Batesville (section 9) and Fayetteville (section 2) formations.

Repository.— UMC 1023-12; UMC 1023-13.

GNATHODUS TEXANUS Roundy

Pl. 1, figs. 1, 2.

Gnathodus texanus ROUNDY, 1926, p. 12, pl. 2, figs. 7a, b, 8a, b.

(?) Gnathodus texanus Roundy, DRUCE, 1969, p. 63, pl. 7, figs. 1-3; DUNN, 1970, p. 32, pl. 32, fig. 21.

Gnathodus texanus texanus Roundy, THOMPSON and FELLOWS, 1970, p. 89, pl. 2, figs. 15, 16.

For complete synonomy and diagnosis see Thompson and Fellows (1970, p. 87-89).

Remarks.— *Gnathodus texanus* Roundy was originally described from strata of Chesterian age (Roundy, 1926). The Meramecian (Valmeyeran) reports of Rexroad and Collinson (1963, 1965) and others on Chesterian strata of the Mississippian type region described this species as abundant in upper Osagean and Meramecian rocks. It appears to be absent in the upper Meramecian strata, but is known from the lower Chesterian Downeys Bluff (Rexroad and Liebe, 1962) in the type area. It may possibly occur much higher in the Series in the southern province.

Occurrence.— *Gnathodus texanus* has a known range from upper Osagean into lower Chesterian.

Material studied.— 90 specimens recovered from the Hindsville Limestone (sections 1-5) and Batesville Formation (sections 2, 9).

Repository.– UMC 1023-14; UMC 1023-15.

Genus LIGONODINA Ulrich and Bassler, 1926

LIGONODINA REXROADI Thompson, n. sp.
Pl. 1, figs. 23-25.

Ligonodina sp. YOUNGQUIST and MILLER (part), 1949, pl. 101, fig. 11 only.

Ligonodina hamata REXROAD, 1957, p. 32, pl. 1, figs. 24, 25; ——, 1958, p.21, pl. 3, figs. 9-14; REXROAD and BURTON, 1961, p.1154, pl. 141, figs. 5, 6.

Ligonodina sp. REXROAD, 1957, p.33, pl. 1, figs. 20, 21.

Ligonodina n. sp.? REXROAD and BURTON, 1961, p.1154, pl. 141, figs.2-4.

Ligonodina n. sp. THOMPSON and GOEBEL, 1969, p.34, pl. 2, figs. 7, 8, 18.

Description.– Unit with straight narrow posterior bar possessing several minute discrete denticles. Terminal denticle long and slender, bowed slightly toward posterior. First denticle of lateral process directly anterior of terminal denticle; lateral process bends 90 degrees inward beneath this first denticle. Lateral process possesses several more slightly curved discrete denticles, and projects aborally and inward from first anterior denticle. Small basal cavity located beneath terminal denticle at juncture of this denticle with posterior bar.

Remarks.– The anterior position of the first denticle of the lateral process is the diagnostic character of *Ligonodina rexroadi* n. sp. It has been identified in three separate studies by this author. The presence or absence of aboral flexure of the lateral process is not considered significant at this time. *L. hamata* Rexroad is superseded by *L. hamata* Bryant (1921), a form now considered to represent the genus *Prioniodus* (C.B. Rexroad, pers. comm. 1970).

Occurrence.— *Ligonodina rexroadi* has been recovered from the St. Louis Limestone in its type area in east-central Missouri (Thompson, 1966) and in Kansas (Thompson and Goebel, 1969). Rexroad (1957) reported this form to range through the entire Chesterian Series in southern Illinois.

Material studied.— 56 specimens recovered from the Hindsville (sections 1-5), Batesville (sections 2,9), Fayetteville (sections 2,4), Pitkin (sections 6, 8), and Carterville (section 11) formations.

Repository.— UMC 1023-16; UMC 1023-17. Holotype of *L. rexroadi* n. sp. reposited at Illinois Geological Survey, 2P35 (holotype of *L. hamata* Rexroad).

Genus NEOPRIONIODUS Rhodes and Müller, 1956

NEOPRIONIODUS SINGULARIS (Hass)
Pl. 1, figs. 21, 22.

Prioniodus barbatus Branson and Mehl, ELLISON and GRAVES (part), 1941, p. 3, pl. 1, fig. 25 only.

Lochreia montanaensis SCOTT (part), 1942, p.289, pl. 29, fig. 9 only; pl. 40, fig. 12.

Prioniodus singularis HASS, 1953, p. 88, pl. 16, fig. 4.

Prioniodus cf. *singularis* Hass, ELIAS, 1956, p. 112, pl. 2, fig. 45.

Prioniodus roundyi var. *dividen* ELIAS, 1956, p.110, pl. 2, figs. 39-41.

Prioniodus roundyi var. *parviden* ELIAS, 1956, p.112, pl. 2, figs. 42, 43.

Prioniodina alatoidea (Cooper), BISCHOFF, 1957, p. 45, pl. 5, figs. 33, 34, 36.

Prioniodus sp. A. ZIEGLER, 1957, p.50, pl. 4, fig. 3.

Neoprioniodus singularis (Hass), STANLEY, 1958, p.471, pl. 61, figs. 2,3; HIGGINS, 1961, pl. 11, fig. 5; ______, 1962, pl. 1, fig 8; BOUCKAERT and HIGGINS, 1963, p.17, fig. 3; REXROAD and FURNISH, 1964, p.674, pl. 111, fig. 33; GLOBENSKY, 1966, p.444, pl. 55, figs. 23, 24; KOIKE, 1967, p.307, pl. 4, fig. 30; HIGGINS and BOUCKAERT, 1968, p.45, pl. 1, fig. 8; WEBSTER, 1969, p.40, pl. 7, fig. 14; REYNOLDS, 1970, p.15, pl. 3, fig. 12.

Neoprioniodus montanaensis (Scott), RHODES, AUSTIN, and DRUCE, 1969, p. 160, pl. 22, figs. 5a-8b.

Diagnosis.– Neoprioniodid characterized by gradual lengthening of posterior bar denticles toward anterior cusp; last one or two approaching cusp in length.

Remarks.– Scott (1942) illustrated a specimen recovered within the conodont assemblage *Lochreia montanaensis* Scott that has subsequently been recognized as representing the discrete species *Neoprioniodus singularis* (Hass). Rhodes, Austin, and Druce (1969) considered *N. singularis,* therefore, to be a junior synonym of *L. montanaensis,* in spite of the fact that *L. montanaensis* was intended for the entire assemblage, not a single element. In view of the increasing number of multi-element names appearing in conodont literature based on the oldest name of one of the included form-species, it is not felt to be necessary to confuse matters by reversing this procedure in this case; naming a form-species from one of the multi-element (assemblage) names. Therefore, *N. singularis* is retained as the name for this discrete element.

Occurrence.– *Neoprioniodus singularis* is known from rocks of upper Mississippian age (Meramecian and Chesterian).

Material studied.– 10 specimens recovered from the Fayetteville (sections 2, 3) and Pitkin (sections 8, 10) formations.

Repository.– UMC 1023-18; UMC 1923-19.

Genus SPATHOGNATHODUS Branson and Mehl, 1941

SPATHOGNATHODUS MURICATUS (Dunn)
Pl. 1, figs. 8-19.

Cavusgnathus muricata DUNN, 1965, p. 1147, pl. 140, figs. 1-4.

Idiognathoides minuta HIGGINS and BOUCKAERT, 1968, p.40, pl. 6, figs. 7-12.

Spathognathodus n. sp. THOMPSON and GOEBEL, 1969, p.43, pl. 1, figs. 9, 15-17.

Gnathodus muricatus (Dunn), WEBSTER, 1969, p.32, pl. 5, figs. 1-7.

Rhachistognathus muricatus (Dunn), DUNN, 1970a, p.338, pl. 61, figs. 5-7, Text-fig. 11c; ________ , 1970b, p.2971, fig. 4.

Diagnosis.— Left-sided double-rowed spathognathodid with long, narrow posterior parapet paralleling curved carina, joining it at or near posterior end of specimen.

Remarks.— *Spathognathodus muricatus* (Dunn) possesses a shallow median trough between the main blade or "carina" and the paralleling parapet over most of the posterior half of the specimen, thus differing from *Rhachistognathus* which possesses no such trough (Dunn, 1966, p.301). The ornamentation on the long "platform" consists of discrete nodes. Webster (1969, p.33) believed this form to be a gnathodid, at least in part because he considered *G. girtyi simplex* Dunn as the possible ancestor for it. However, the specimens of this study are much older than previously described specimens, except for those of Thompson and Goebel (1969), and occur with *G. girtyi girtyi,* which is an older form than Webster's supposed ancestor.

Occurrence.— *Spathognathodus muricatus* has previously been reported from rocks of latest Chesterian or early Morrowan (Pennsylvanian) age. An exception is the late Meramecian recovery by Thompson and Goebel (1969).

Material studied.— 24 specimens recovered from the Hindsville Limestone in Missouri (sections 1-3).

Repository.— UMC 1023-20; UMC 1024-1; UMC 1024-2; UMC 1024-3; UMC 1024-4; UMC 1024-5.

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PLATE I

All figures are unretouched photographs (X40). Figured specimens are reposited at the University of Missouri, Columbia (UMC). Sections from which specimens were recovered are catalogued by Missouri Geological Survey and Water Resources field notebook number 1294.

PLATE I

FIGS. 1, 2. *Gnathodus texanus* Roundy. *1,* oral view; UMC 1023-14. *2,* oral view; UMC 1023-15. Hindsville Limestone (MGS 1294-81-2).

3-5. *Gnathodus mononodosus* Rhodes, Austin, and Druce. *3,* oral view; *5,* aboral view; UMC 1023-12; Hindsville Limestone (MGS 1294-52-4A). *4,* oral view; UMC 1023-13; Fayetteville Formation (MGS 1294-66-12C).

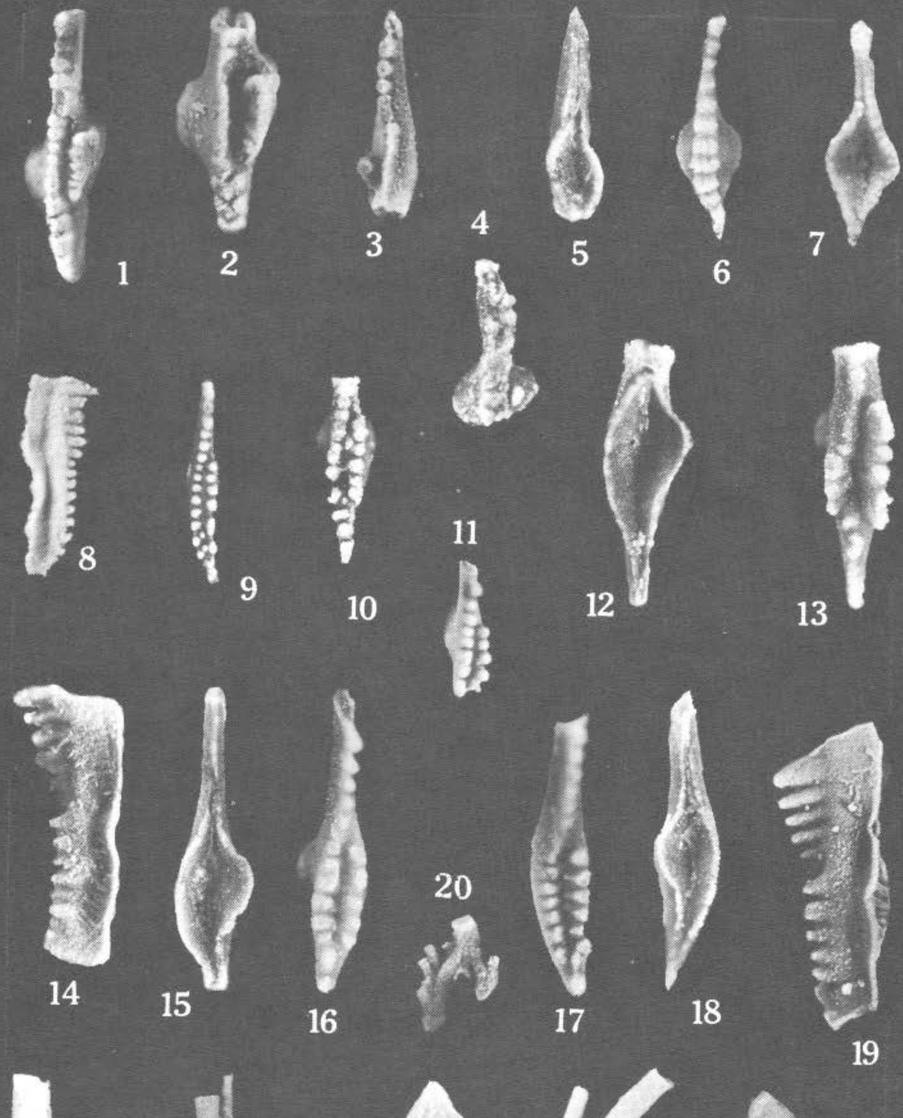
6, 7. *Gnathodus commutatus* (Branson and Mehl). *6,* oral view; *7,* aboral view; UMC 1023-11; Fayetteville Formation (MGS 1294-66-13A).

8-19. *Spathognathodus muricatus* (Dunn). *8,* outer-lateral view; *9,* oral view; UMC 1023-20 (MGS 1294-52-3). *10,* oral view; UMC 1024-1 (MGS 1294-52-4B). *11,* oral view; UMC 1924-2 (MGS 1294-81-2). *12,* aboral view; *13,* oral view; UMC 1024-3 (MGS 1294-52-13). *14,* outer-lateral view; *15,* aboral view; *16,* oral view; UMC 1024-4 (MGS 1294-52-13). *17,* oral view; *18,* aboral view; *19,* outer-lateral view; UMC 1024-5 (MGS 1294-52-13). All from Hindsville Limestone.

20. *Apatognathus* sp. Inner-lateral view; UMC 1023-10; Hindsville Limestone (MGS 1294-66-4C).

21-22. *Neoprioniodus singularis* (Hass). *21,* lateral view; UMC 1023-19; Pitkin Formation (MGS 1294-69-2). *22,* lateral view; UMC 1023-19; Fayetteville Formation (MGS 1294-81-12B).

23-25. *Ligonodina rexroadi* Thompson, n. sp. *23,* inner-lateral view; *25,* outer-lateral view; UMC 1023-16 (MGS 1294-77-3). *24,* inner-lateral view; UMC 1023-17; (MGS 1294-66-9A). Both Batesville Formation. Holotype reposited in Illinois Geological Survey, 2P35.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CONODONT BIOSTRATIGRAPHY OF CHESTERIAN STRATA IN SOUTHWESTERN MISSOURI RI 50

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