

ABSTRACT

The conodont fauna of the Upper Mississippian Paoli and equivalent formations in the outcrop area around the margin of the Illinois Basin is described, on the basis of samples collected from eight localities in Illinois, Kentucky, and Indiana, which yielded an average of seven specimens per kilogram of sample. Twenty-six species, including the new species *Synprioniodina denticamurra*, and thirteen genera were recognized. There are faunal differences between the lower and upper members of the Paoli, and conodonts are somewhat more abundant in the northern localities. There is no apparent lithofacies control of distribution.

Conodonts from the Paoli and equivalent formations in the Illinois Basin

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INTRODUCTION

This description of the Paoli conodonts is part of a broad program of stratigraphic investigation of the Mississippian system aimed at expanding knowledge of the faunas near the base of the Chesterian to clarify stratigraphic relationships and to provide a broader base for correlation. It is hoped that zonations of the North American Chesterian and of equivalent units in Europe ultimately will allow precise intercontinental correlations.

The Paoli limestone, named by Elrod (1899), is a dominantly limestone unit overlying the Levias limestone (or the Aux Vases sandstone where the Levias is lacking) and underlying the Bethel sandstone. The name Paoli is used in Indiana and Kentucky; in Illinois the equivalent units include, in ascending order, the Shetlerville limestone member of the Renault formation, the Yankeetown formation, and the Downeys Bluff limestone. In nearly all Indiana outcrops the Yankeetown equivalent can be recognized as the middle shaly member of the Paoli, which makes possible ready correlation of the Shetlerville and Downeys Bluff with the lower and upper members of the Paoli limestone, respectively.

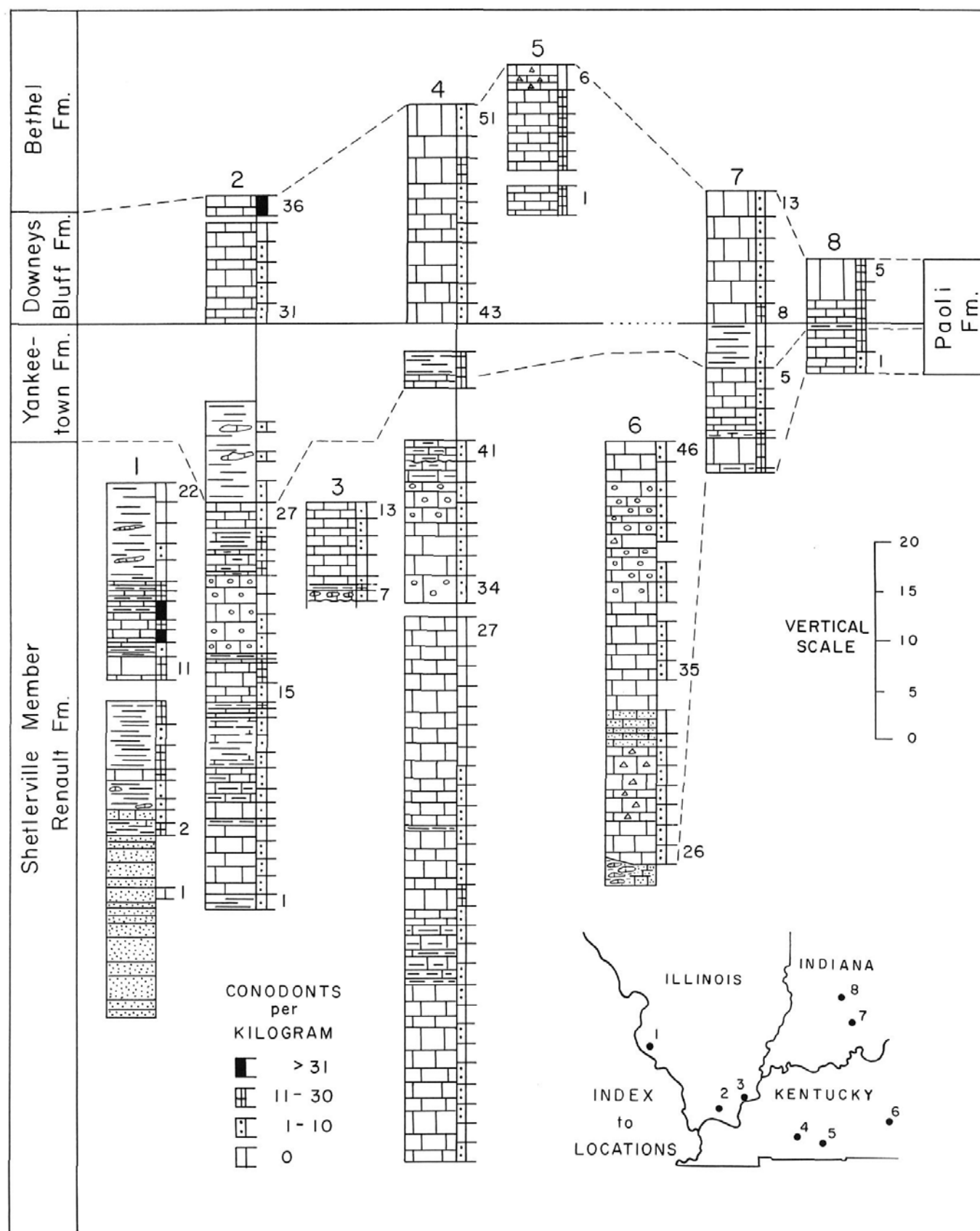
The Paoli and its Illinois equivalents were sampled from eight localities around the margin of the Illinois Basin, including the type sections of the Paoli and Shetlerville and a section in the type area of the Renault formation. The locations and lithologies of the sections studied, along with conodont-bearing zones, are detailed in text-figure 1.

ACKNOWLEDGEMENTS

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THE CONODONT FAUNA

On the whole, conodonts are uncommon in the Paoli formation and its equivalent units in the Illinois Basin (an average of seven specimens per kilogram), but a collection of slightly over 2800 generically identifiable specimens was obtained for study. Indigenous to the unit are 26 named species, one new, representing the following eleven genera, listed in order of total abundance: *Cavusgnathus*, *Spathognathodus*, *Neoprioniodus* and *Ligonodina*, *Ozarkodina*, *Hibbardella*, *Gnathodus*, *Lambdagnathus*, *Synprioniodina*, *Falcodus* (?), and *Elsonella* (?). The first four genera would be considered common and the last four rare. Specimens of an apparently new genus are nearly as common as the hibbardellids, and fragments of a thirteenth genus, *Hindeodella*, are common, but complete specimens are rare. The fragments of *Polygnathus* found at locality 1 and of *Apatognathus* at locality 6 (samples 22, 25 and 27) are considered to be reworked specimens. In addition, a single specimen is tentatively identified as *Neoprioniodus varians* (Branson



TEXT-FIGURE 1

Sections showing lithologies, conodont abundances, and geographic locations. See the "Register of Localities" for precise locations.

UPPER MISSISSIPPIAN CONODONTS

TABLE 1

GEOGRAPHIC OCCURRENCE OF CONODONT SPECIES

Locality numbers refer to outcrops shown in text-figure 1 and listed in the "Register of Localities". S and DB refer, respectively, to Shetlerville and Downey Bluff and their lateral equivalents in the Paoli formation.

LOCALITY	1S	2S	2DB	3S	4S	4DB	5DB	6	7S	7DB	8S	8DB
<i>Cavusgnathus</i> spp.	x	x	x	x	x	x	x	x	x	x	x	x
<i>C. characta</i>	x	—	x	—	x	—	x	x	—	—	—	—
<i>C. convexa</i>	x	x	x	—	x	—	x	—	x	x	—	—
<i>C. regularis</i>	x	x	x	x	x	—	x	x	x	x	x	—
<i>C. unicornis</i>	x	x	x	x	x	x	x	x	x	x	x	x
<i>Elsonella</i> ? spp.	x	—	—	—	x	—	x	x	x	x	—	—
<i>E.</i> ? <i>imperfecta</i>	x	—	—	—	x	—	x	x	x	x	—	—
<i>Falcodus</i> ? spp.	x	—	—	x	x	x	x	x	—	—	—	—
<i>F.</i> ? <i>alatoides</i>	x	—	—	—	x	—	—	—	—	—	—	—
<i>Gnathodus</i> spp.	x	—	x	—	—	x	x	—	—	x	—	x
<i>G. bilineatus</i>	x	—	x	—	—	x	x	—	—	x	—	x
<i>G. modocensis</i>	x	—	x	—	—	x	x	—	—	x	—	x
<i>G. commutatus</i>	—	—	x	—	—	x	x	—	—	x	—	x
<i>G. texanus</i>	—	—	x	—	—	—	—	—	—	—	—	—
<i>Hibbardella</i> spp.	x	x	x	x	x	x		x			—	—
<i>H. milleri</i>	x	x	x	—	x	x	x	x	x	x	—	—
<i>H. ortha</i>	x	—	x	—	—	—	—	x	—	—	—	—
<i>Hindeodella</i> spp.	x	x	x	x	x	x	x	x	x	x	x	x
<i>Lambdagnathus</i> spp.	x	—	x	—	x	—	—	x	x	x	—	—
<i>L. fragilidens</i>	x	—	—	—	x	—	—	x	—	—	—	—
<i>Ligonodina</i> spp.	x	x	x	x	x	x	x	x	x	x	x	x
<i>L. hamata</i>	x	x	x	—	x	x	x	x	x	x	x	x
<i>L. levis</i>	x	—	x	x	x	x	x	x	x	x	—	—
<i>Neoprioniodus</i> spp.	x	x	x	x	x	x	x	x	x	x	x	x
<i>N. camurus</i>	—	—	—	—	x	x	x	x	x	x	—	—
<i>N. peracutus</i>	x	—	x	—	x	x	x	x	—	x	—	x
<i>N. loxus</i>	x	x	x	—	x	—	x	—	x	x	—	—
<i>N. scitulus</i>	x	x	x	x	x	x	x	x	x	x	x	—
<i>N. singularis</i>	—	—	x	—	—	x	x	—	—	—	—	—
<i>Ozarkodina</i> spp.	x	x	x	x	x	x	x	x	—	x	x	x
<i>O. compressa</i>	x	x	x	—	x	—	—	x	—	—	—	—
<i>O. curvata</i>	x	—	x	—	x	x	x	x	—	x	—	—
<i>O. recta</i>	x	x	x	—	x	—	—	—	—	—	—	—
<i>Spathognathodus</i> spp.	x	x	x	x	x	x	x	x	x	x	x	x
<i>S. campbelli</i>	x	x	x	—	x	x	x	—	—	x	—	—
<i>S. cristula</i>	x	x	x	x	x	x	x	x	x	x	x	x
<i>S. spiculus</i>	x	x	x	—	x	x	—	x	x	x	—	—
<i>Synprioniodina</i> spp.	x	—	—	—	x	x	x	x	—	—	—	—
<i>S. denticamurra</i>	x	—	—	—	x	x	x	—	—	—	—	—
New genus? spp.	x	x	x	—	x	x	x	x	x	x	—	x

and Mehl). The occurrence of conodont species is summarized in Table 1.

The fauna is moderately homogeneous, but there are significant differences between the conodonts of the lower member of the Paoli and the Shetlerville as opposed to the upper member of the Paoli and the Downes Bluff. At the generic level, *Cavusgnathus* decreases from 31% in the lower unit to 19% in the upper unit, and there is a corresponding increase upward for *Gnathodus* from less than 1% to 8%. Because of the decrease in *Cavusgnathus*, *Spathognathodus* is the most abundant genus in the upper member of the Paoli. *Cavusgnathus unicornis* is the most abundant species in the lower unit and *Spathognathodus cristula* the most abundant in the upper. The abundances of the species of *Spathognathodus* also differ between the lower and upper members. *S. spiculus* decreases upward from 15% to 7%, *S. cristula* increases upward from 11% to 20%, and *S. campbelli* increases upward from 2% to 5%. *Neoprioniodus singularis*, although a minor element, is found only in the upper unit.

The slight variations in the geographic distribution of the species studied must be attributed to sampling procedures, except that conodonts are somewhat more abundant in the northern sections (localities 1, 7, and 8). No lithofacies control is apparent in the distribution or abundances recorded.

The range of only one species, *Synprioniodina denticamura*, n. sp., was extended by this study; it is now recorded from the Downes Bluff as well as the Renault. The fact that a number of species known only from higher parts of the Chesterian series were not represented in the Paoli helps to verify the lower limits of these species in the Illinois Basin as being post-Paoli. Ranges of Chesterian conodonts in the Illinois Basin have been summarized in chart form by Rexroad and Collinson (1961). However, there is some question about the occurrence of *Neoprioniodus varians* in the Paoli, and *Cavusgnathus cristula* (Branson and Mehl) was erroneously reported from the Renault at locality 1.

CONCLUSIONS

Even though conodonts are uncommon in the Paoli, the formation and its lateral equivalents carry a varied conodont fauna. Differences among *Cavusgnathus*, *Gnathodus*, and *Spathognathodus* in particular distinguish the lower and upper members of the Paoli, but within each of these two units the geographic distribution of conodonts is quite uniform, varying only in that specimens are more abundant in the northern localities. There is no lithofacies control of the conodonts.

REGISTER OF LOCALITIES

Locality 1: Dry Fork East; banks of lowest tributary gully to south of Dry Fork Creek, SE $\frac{1}{4}$ SW $\frac{1}{4}$ sec. 23, T. 4 S., R. 9 W., Renault quadrangle, Monroe County, Illinois (Rexroad, 1957, p. 11).

Locality 2: Belknap Quarry; abandoned quarry approximately 0.6 miles northeast of Belknap on the northwest

side of road, NE $\frac{1}{4}$ NE $\frac{1}{4}$ sec. 1, T. 14 S., R. 2 E., Vienna quadrangle, Johnson County, Illinois (Swann, 1956, p. 9).

Locality 3: Shetlerville Quarry; abandoned quarry in Shetlerville, NE $\frac{1}{4}$ SW $\frac{1}{4}$ sec. 35, T. 12 S., R. 7 E., Golconda quadrangle, Hardin County, Illinois.

Locality 4: Hopkinsville; Christian Quarry, 0.2 miles south of U.S. Highway 68 from a point about 0.7 miles east of city limits (junction U.S. Highways 68 and 41) of Hopkinsville, Carter coordinates 17-E-25, 2520 feet south of north line, on and west of line between 17-E-25 and 18-E-25, Hopkinsville quadrangle, Christian County, Kentucky (McFarlan et al., 1955, fig. 7 and pl. 3; Stokley & McFarlan, 1952, pp. 36-38).

Locality 5: Elkton East; Kentucky Stone Company Quarry, approximately 0.3 miles north of U.S. Highway 68 from a point 1.3 miles east of courthouse in Elkton, Carter coordinates 8-D-29, 2200 feet south of north line, 800 feet east of west line, Elkton quadrangle, Todd County, Kentucky (McFarlan et al., 1955, fig. 8 and pl. 13).

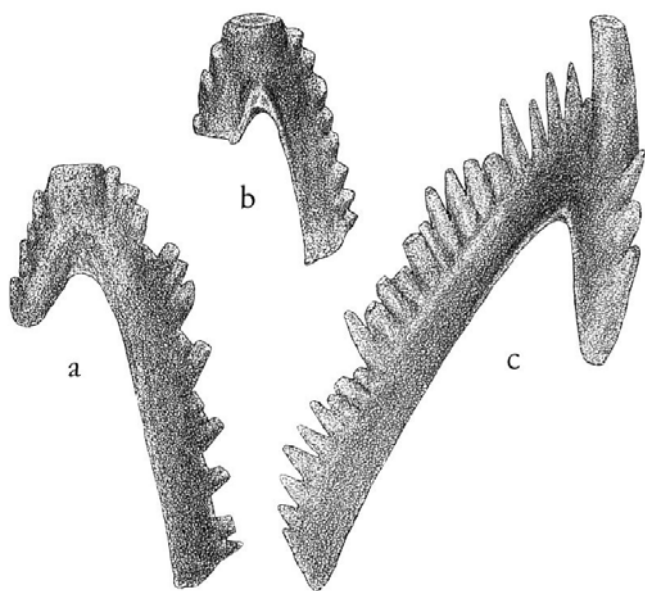
Locality 6: Wooten Knob; McClelland Quarry, at the south end of Wooten Knob approximately 0.2 miles north of State Highway 218 from a point approximately one mile east of Horse Cave, Carter coordinates 23-I-44, 1120 feet south of north line, 3480 feet east of west line, Horse Cave quadrangle, Hart County, Kentucky (McGrain and Walker, 1954, p. 21).

Locality 7: Paoli; abandoned quarry along the Monon Railroad on the west side of Paoli, SE $\frac{1}{4}$ SE $\frac{1}{4}$ sec. 35, T. 2 N., R. 1 W., Paoli quadrangle, Orange County, Indiana (Malott and Esarey, 1940, p. 9ff.).

Locality 8: Springville Quarry; Springville Quarry, about two miles southwest of Springville, SE $\frac{1}{4}$ SE $\frac{1}{4}$ sec. 29 and NE $\frac{1}{4}$ NE $\frac{1}{4}$ sec. 32, T. 6 N., R. 2 W., Owensburg quadrangle, Lawrence County, Indiana (Perry, Smith and Wayne, 1954, p. 26).

SYSTEMATIC PALEONTOLOGY

In order to avoid repetitious descriptions and synonymies of well-known species, only the single new species from the Paoli is described. Publications in which the species studied were originally named are Hinde (1900); Roundy (1926); Branson and Mehl (1940a-b, 1941); Youngquist and Miller (1949); Rexroad (1957, 1958); and Rexroad and Burton (1961). Additional papers that give descriptions of species studied include Bischoff (1957); Clarke (1960); Cooper (1947); Elias (1956, 1959); Ellison and Graves (1941); Flügel and Ziegler (1957); Hass (1950, 1953); Higgins (1961); Holmes (1928); Lys and Serre (1957, 1958); Mehl and Thomas (1947); Rexroad and Collinson (1961); Stanley (1958); and Voges (1959). The material described in this study has been deposited in the collections of the Illinois State Geological Survey.



TEXT-FIGURE 2

Synprioniodina denticamura Rexroad and Liebe, n. sp.
All magnifications $\times 80$; a, outer lateral view of paratype, no. 16P2; b, inner lateral view of paratype, no. 16P3; c, inner lateral view of holotype, no. 16P1.

Genus *Synprioniodina* Ulrich and Bassler, 1926

Type species: *Synprioniodina alternata* Ulrich and Bassler.

Synprioniodina denticamura Rexroad and Liebe, new species Text-figure 2

Synprioniodina sp., REXROAD, 1957, Illinois Geol. Survey, Rept. Invest., no. 199, p. 40, pl. 4, fig. 3.

Diagnosis: This is a synprioniodinid having a relatively short, strongly compressed apical denticle with a denticulate antiscusp approximately one-half as long. The posterior limb is long and thin, bears about twenty subequal denticles, and is sharply bowed immediately posterior to the apical denticle, with little additional bowing. The entire unit is sharply arched.

Description: The posterior limb is long, thin, somewhat arched, and strongly bowed inward near its juncture with the apical denticle but is nearly unbowed posterior to this point. It bears approximately twenty appressed, subround to laterally compressed denticles that decrease only slightly in size posteriorly. The apical denticle is strongly compressed laterally, with sharp edges fore and aft, and the inner face is the more convex in cross section. The antiscusp is a continuation of the apical denticle, and together the two are slightly concave inward, viewed from the anterior. The laterally compressed antiscusp is about one-half the length of the apical denticle and typically bears three or four small, appressed, laterally compressed denticles, the anterior margins of which are subparallel to the apical denticle.

The minute pit is located at the base of the cusp and in outline has very slightly flared lateral lips. The pit is deep, with a sharp point extending into the base of the apical denticle.

Remarks: As indicated by its name, this species is closely similar to *Neoprioniodus camurus* Rexroad, from which it differs in the presence of denticles on the antiscusp. Separation of the two into different genera seems artificial, but because forms with denticulate antiscusps are typical of *Synprioniodina*, the new species was assigned to the latter. However, such forms are not excluded from *Neoprioniodus* Rhodes and Müller, 1956, so that *Neoprioniodus* should either be redefined or considered a junior synonym of *Synprioniodina*. The recorded range of *S. denticamura* is Ste. Genevieve to Beech Creek, whereas that of *N. camurus* is Ste. Genevieve to Kinkaid.

Material studied: Twenty-two specimens.

Repository: Illinois State Geological Survey collections: holotype, no. 16P1, from the Ste. Genevieve formation (sample 26 from the Mississippi Lime Co. quarry, in the NE $\frac{1}{4}$ sec. 8, T. 5 N., R. 9 W., Alton quadrangle, Madison County, Illinois); paratypes, no. 16P2, from the upper Paoli, location 4, sample 44; no. 16P3, from the Renault formation, location 1, sample 14; and no. 2P92 (Rexroad, 1957, pl. 4, fig. 3), location 1, sample 10 of this study.

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