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REPORT OF INVESTIGATIONS 199

CONODONTS FROM THE CHESTER SERIES IN THE TYPE AREA OF SOUTHWESTERN ILLINOIS

BY

CARL B. REXROAD

PRINTED BY AUTHORITY OF THE STATE OF ILLINOIS

URBANA, ILLINOIS

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CONODONTS FROM THE CHESTER SERIES IN THE TYPE AREA OF SOUTHWESTERN ILLINOIS

BY

CARL B. REXROAD

ABSTRACT

The presence of conodonts in the Chester rocks of the type area has been known for some time. This study was undertaken to evaluate their use as Chester guide fossils in the expectation that they would prove valuable aids in correlating other strata in North America and Europe with the type section.

The shales and thin interbedded limestones of the entire stratigraphic sequence were carefully sampled. Zones that contained conodonts were found in all the limestone-shale formations—the Renault, Paint Creek, Golconda, Glen Dean, Vienna, Menard, Clore and Kinkaid.

The fauna consists of 27 identified species that represent nine genera; three additional genera are known from fragments. The genera present are *Cavusgnathus*, *Cladognathus* (a new genus), *Gnathodus*, *Hibbardella*, *Hindeodella*, *Ligonodina*, *Ozarkodina*, *Neoprioniodus*, *Spathognathodus*, *Subbryantodus*, *Synprioniodina*, and *Trichonodella*. Single specimens or groups of fragments represent the polygnathids and two apparently new genera. The fauna is distinct from Kinderhook, Valmeyer, and Pennsylvanian faunas. Species were found to be more useful than genera in subdividing the series.

Similar conodont faunas have been found in the Pella beds of Iowa, the Pitkin limestone of Arkansas and Oklahoma, the lower part of the Stanley shale of Arkansas and Oklahoma, the Barnett formation of Texas, and the portion of the Caney shale studied by Branson and Mehl.

INTRODUCTION

Purpose and Scope

Although conodonts have been proved valuable in stratigraphic correlation, only one paper (Cooper, 1947) describes them from the standard Chester sequence. Additional work by Cooper (unpublished) showed conodonts to be present in Chester rocks of the type area, and it therefore seemed desirable to make a comprehensive study of these conodont faunas in order to evaluate them as guide fossils.

The southern Illinois Chester section is a standard of reference for rocks of upper Mississippian age of the North American continent as well as for comparison with the type sections of Great Britain and continental Europe. It was hoped that a broader base for correlation could be built through the recognition of a Chester conodont sequence. Such a faunal study is particularly important because European geologists have based their zonation of Mississippian rocks primarily upon goniatites, fossils that are rare in the southwestern Illinois area. Conodonts, however, are present in both Europe and various regions of North America. Furthermore, in the type area it is difficult to estimate the portion of Mississippian time represented by the unconformity between the Mississippian and Pennsylvanian strata, but comprehensive studies that include the study of conodonts are being made in Oklahoma on a sequence of strata apparently transitional from Mississippian into Pennsylvanian.

The fact that this is the first study of Chester conodonts from the area surrounding Chester, Illinois, imposes limitations on the problem. The complete stratigraphic sequence was sampled. Therefore, the great thickness of strata analyzed for vertical distribution of the fossils precluded collection at widely separated points to determine lateral variations of the conodont-bearing units. Thus, the collection adequately establishes the Chester fauna as a unit, but the basis for detailed subdivisions is less definite. The diversity of the present fauna indicates, however, that future work will establish valid distinctions between the formations.

Acknowledgments

Among the numerous people who generously gave time and energy to this study, several deserve special mention. C. W. Col-

linson planned and coordinated the study, giving guidance throughout the project both in the laboratory and in the field. D. H. Swann provided the stratigraphic control for the project and not only made his field notes available but also spent time in the field, both with the author and separately to assure accuracy in the published stratigraphic sections. H. B. Willman gave valuable criticism of the manuscript. All are with the Illinois State Geological Survey. W. M. Furnish, of the State University of Iowa, directed the systematic paleontology and critically read the manuscript.

Nearly a week was spent in Columbia, Missouri, examining the collections of the University of Missouri through the courtesy of M. G. Mehl, whose advice and discussions of taxonomy were most helpful. Preston E. Cloud and Wilbert H. Hass of the United States Geological Survey sent material from the Barnett formation of Texas for comparative study, and Carlyle B. Campbell of Knoxville, Iowa, gave residues from the Pella beds of Iowa. M. K. Elias of the Nebraska Geological Survey contributed photographs of the plates from his unpublished manuscript.

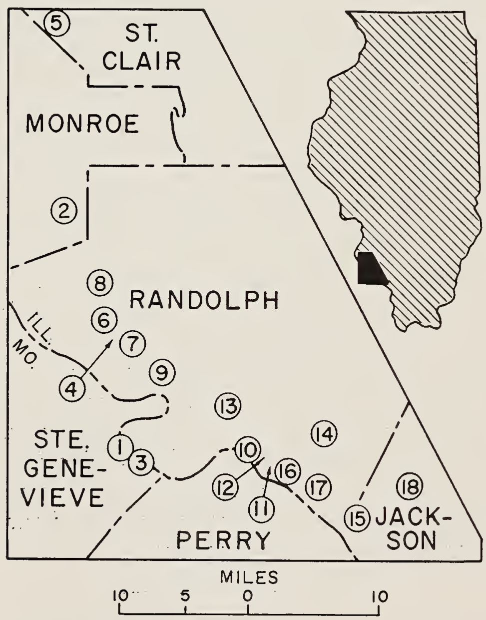


Fig. 1.—Localities from which Chester conodonts were collected. See outcrop diagrams (figs. 4–12) for detailed descriptions.

STRATIGRAPHIC SUMMARY

The stratigraphy of the Chester series (upper Mississippian) as developed in the type region in Monroe, Randolph, and Jackson counties, Illinois, and Ste. Genevieve County, Missouri, is shown in figure 2. The formations recognized in the lower and upper parts of the series—beneath the Cypress and above the Waltersburg—are named from localities in this area. The figure shows the relation of three formations, the Ruma, Okaw, and Baldwin, to their correlatives from eastern Illinois and Kentucky. The above names were used originally for the type region but they have been replaced by the Cypress, Golconda, Hardinsburg, Glen Dean, Tar Springs, Vienna, and Waltersburg in the standard column.

The Hardinsburg formation in the area is a soft shale, in part red, with thin siltstone lenses; the cherty limestone that has been mentioned in the literature as representing the Hardinsburg is in the lower part of the Glen Dean limestone.

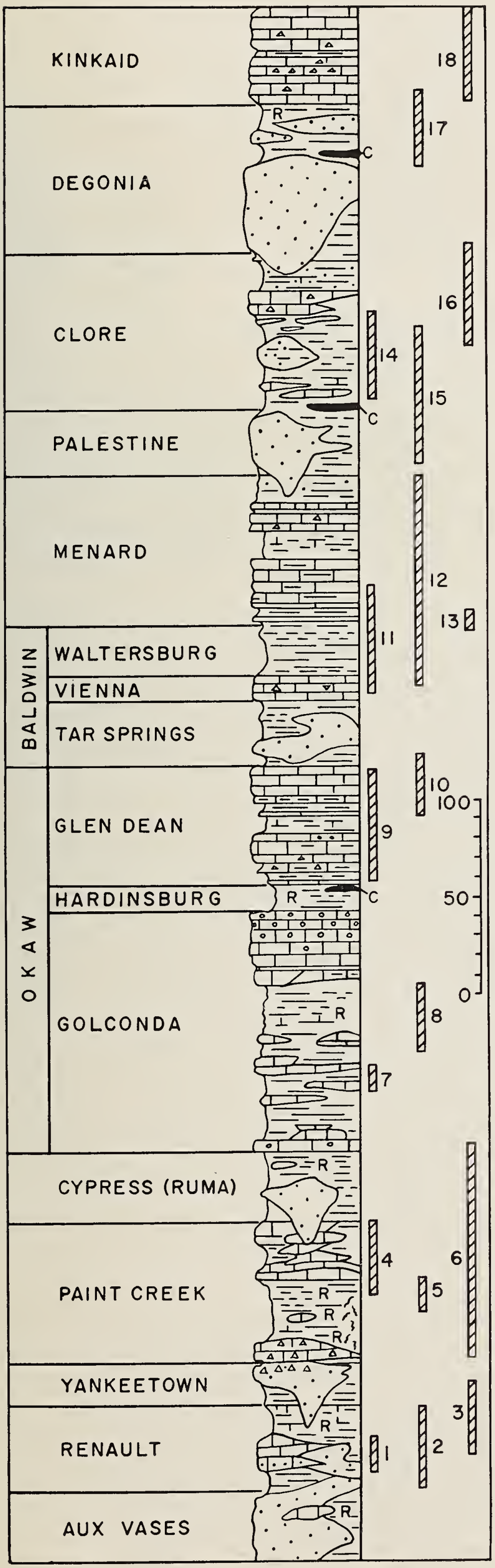
Nineteen outcrop sections were selected and shales in each outcrop were sampled. Conodonts occurred in eighteen of the sections. The geographic position of the productive localities is shown in figure 1 and the stratigraphic position on figure 2. The sections exposed and the positions of the productive and barren samples are detailed for each outcrop in figures 4 to 21. The barren outcrop was in the middle of the Paint Creek formation and is equivalent to the lower barren part of the section at locality 6, Modoc East.

METHODS OF STUDY

Collecting

Only sections whose stratigraphic positions are well established were chosen as collecting localities. The locations were selected also because they displayed a continuous, long, vertical section with well developed shales. Where possible, sections with exposed formation boundaries were chosen.

Only the shales and thin interbedded limestones were sampled. In order not to miss any zones that might contain conodonts,



sampling was done by continuous trenching, with each sample a representative composite of a 6-inch, 1-foot, or 2-foot section, depending on the thickness of the lithologic unit being sampled. The vertical interval sampled was modified, where necessary, in order not to include material from two lithologic zones in one sample.

The samples were then processed in the laboratory and the fossiliferous zones determined. Later, bulk samples were taken from each zone that contained conodonts.

Processing

In the laboratory the limestones were dissolved in 15 percent acetic acid to free the conodonts. The shales were dissociated either by washing the samples in the Campbell micro-fossil washing machine or by boiling them with sal soda. The former method proved superior for the more highly indurated shales, the latter for the soft shales.

The residues were screened and the portion retained between the 16- and 115-mesh screens was examined. Many of the residues contained large quantities of calcitic material that was removed by acetic acid after a preliminary examination under the binocular microscope. The conodonts were further concentrated by gravity separation in tetrabromoethane whenever large quartzose residues remained.

THE CONODONT FAUNA

Nature and Distribution

Conodonts are present in moderate abundance in eight of the standard Chester formations, but none were found in the other formations. The eight formations that contain conodonts are the Renault, Paint Creek, Golconda, Glen Dean, Vienna, Menard, Clore, and Kinkaid—that is, the alternate formations in the sequence. As might be expected, the above formations all contain marine beds. The formations that do not have conodonts contain *Lepidodendron,* coal, and

Fig. 2.—Generalized geologic column of the Chester series in the type area. Cross-hatched bars show stratigraphic intervals illustrated by outcrop diagrams (figs. 4 to 21). (Stratigraphic section by D. H. Swann.) R = red shale. C = coal.

plant spores, all of which indicate an absence of typical marine conditions.

Twenty-seven species of conodonts belonging in nine genera are identified, and three additional genera are recognized from fragments. Single specimens or groups of fragments represent a number of additional species from these genera and from polygnathid types. In addition, there are almost certainly two new genera, unfortunately represented by specimens too fragmentary to allow detailed description. Broken material was used for description of new species only when a reasonable composite could be assembled. No new species are based on single specimens.

In samples from a location about 25 miles south and east of the type locality of the Kinkaid formation, Cooper (1947) identified the genus *Taphrognathus,* which was not found in the present collection.

Stratigraphically, the new genus *Cladognathus* is the most significant. Its first appearance is in the Glen Dean formation, and although both the Renault and Paint Creek formations, which are older, have an abundant and varied conodont fauna, no representatives of the genus were found, a fact that

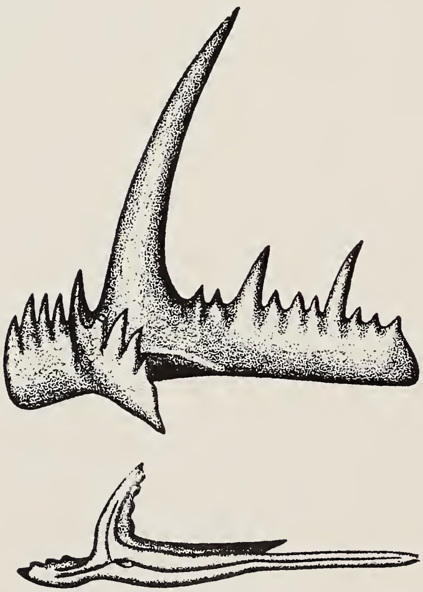


Fig. 3.—Diagrammatic reconstruction of *Cladognathus* Rexroad, n. gen., showing lateral and aboral views.

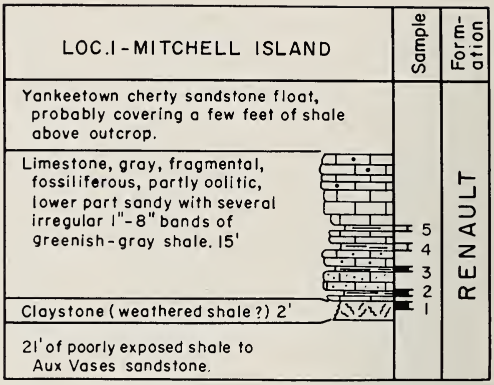


Fig. 4.—Mitchell Island, locality 1. Bluff of abandoned (1881) Mississippi River channel opposite former Mitchell Island, midway between mouths of River Aux Vases and Saline Creek, and below a point on state highway 25, 0.8 mile southeast of River Aux Vases bridge, near center E½ sec. 13 (extended), T. 37 N., R. 9 E., Chester quadrangle, Ste. Genevieve County, Missouri.

suggests that *Cladognathus* does not range below the Glen Dean. The upper limit of *Cladognathus* is the Kinkaid formation.

As far as I have been able to ascertain, fragments of the two indeterminable "new genera" of the type Chester have not been recorded in rocks of any other age. One of the two has been recorded in the Caney shales of Oklahoma by Branson and Mehl (1940) as *Lonchodina* sp. and in the Pella beds of Iowa by Youngquist and Miller (1949) as *Lonchodina*? sp. Both "new genera" are found in all eight Chester formations that contain conodonts.

More than half the remaining genera have long stratigraphic ranges, from Ordovician or Silurian into the Permian or Triassic. These genera include: *Spathognathodus, Ozarkodina, Trichonodella, Neoprioniodus, Ligonodina,* and *Hindeodella.* All are abundant in the Chester collections. *Hibbardella* and *Synprioniodina* have ranges nearly as long.

There are several points of interest concerning the other genera. *Subbryantodus* is not common in the Chester and is limited to the Glen Dean and Menard formations, but it is usually considered a lower Mississippian form; *Subbryantodus roundyi* Hass from the Barnett shale of Texas is referred to *Ozarkodina* in this paper.

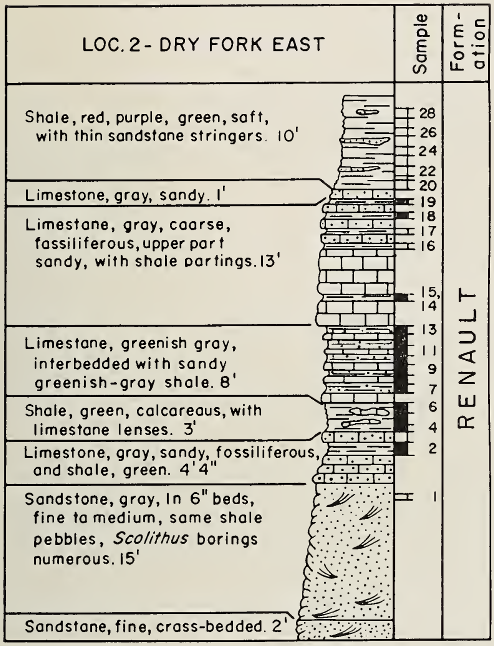


Fig. 5.—Dry Fork East, locality 2. Banks of lowest tributary gulley to south of Dry Fork Creek, SE¼ SW¼ sec. 23, T. 4 S., R. 9 W., Renault quadrangle, Monroe County, Illinois.

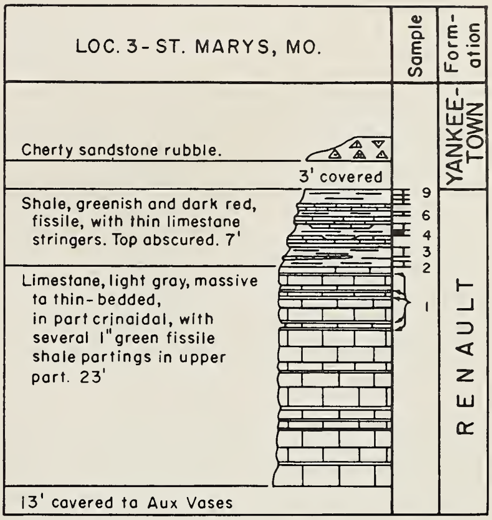


Fig. 6.—St. Marys, Missouri, locality 3. Roadcut on state highway 25, 0.7 mile northwest of bridge in St. Marys and 1.5 miles southeast of bridge over Saline Creek, NW¼ NW¼ sec. 29 (extended), T. 37 N., R. 10 E., Chester quadrangle, Ste. Genevieve County, Missouri.

Gnathodus, whose range includes all the Mississippian and the lower half of the Pennsylvanian, was found only in the Paint Creek formation, but was present at two widely separated outcrops. Three polygnathid fragments from two locations in the Renault formation are also of considerable interest because representatives of *Polygnathus* found previously by other workers in rocks of Chester age or younger have been considered as reworked. There is no evidence, however, that such is the case here. The only other genus confined to a portion of the series is *Synprioniodina,* but it is represented by only two fragments, both from the Renault formation.

Cavusgnathus is an important element of the Chester fauna. It probably appears first in rocks of Chester age but continues its development into the Permian.

In the type Chester strata, forms suggestive of the Pennsylvanian generally are lacking, so that the over-all aspect of the fauna is Mississippian. The Chester fauna also differs distinctively from faunas characteristic of Kinderhook and Valmeyer rocks. Genera characteristic of and forming an important part of assemblages in those older rocks are absent in the Chester, nor were the long range genera, *Prioniodina, Eurprioniodina, Lonchodina,* and *Prioniodella,* recognized among the Chester conodonts.

In terms of genera, the fauna described here is definitive of the type Chester series as a whole. In general, it appears that species will be more useful than genera in subdividing the series. Table 1 presents the stratigraphic distribution of the Chester conodonts.

Correlations

As yet the literature on Chester conodonts is small. A number of reports mention conodonts only briefly, and several additional papers describe groups of conodonts as natural assemblages from single animals. In the latter case individual specimens are neither described nor illustrated in detail, so that their usefulness for stratigraphic correlation is limited. Fay's *Catalogue of Conodonts* (1952) is readily available and gives most references to Chester conodonts. Several of

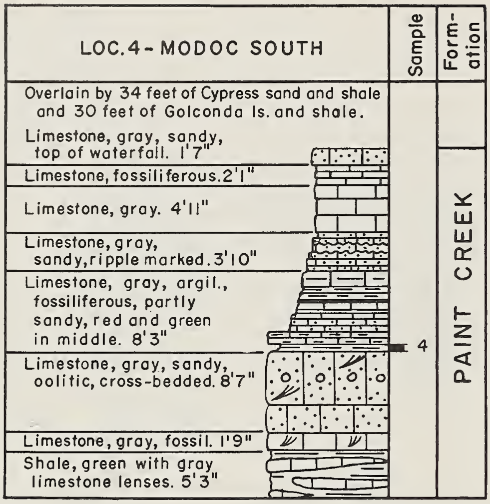


Fig. 7.—Modoc South, locality 4. Mouth of fourth ravine, about 2.6 miles southeast of Modoc, SW¼ SW¼ sec. 4 (extended), T. 6 S., R. 8 W., Baldwin-Renault quadrangle line, Randolph County, Illinois.

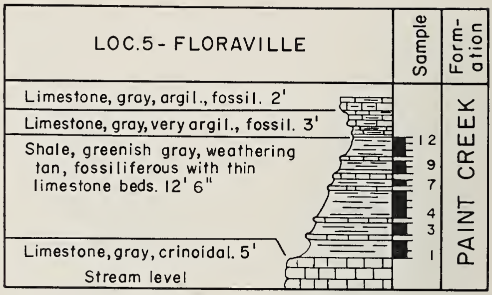


Fig. 8.—Floraville, locality 5. Northeast bank of Prairie du Long Creek just above bridge 0.7 mile northeast of Vogel School, midpoint of section line between secs. 3 and 10, T. 2 S., R. 9 W., Waterloo quadrangle, St. Clair County, Illinois.

the papers, however, merit mention here, and a few more deserve a fuller discussion.

Demanet in 1941 discussed several genera of conodonts from all three zones of the Lower Namurian in the type region of Belgium. In terms of cephalopods these would be, in ascending order, the zones of *Eumorphoceras pseudobilinque, E. bisculatum,* and *Homoceras beyrichianum.* Three years earlier (1938) the same author described and figured several genera from the upper beds of passage between the Viséan and Namurian. It thus is known that conodonts are present in most of the European standard section that corresponds to the Chester in age. In both articles Demanet used the concept of genetic assemblages, apparently following the ideas of Hermann Schmidt. In 1934 Schmidt, in discussing zoological affinities of conodonts, described several genetic assemblages from the *Eumorphoceras pseudobilingue, Cravenoceras edalense,* and *E. bisculatum* zones developed in the Arnsberger graywacke of Germany. Genetic assemblages also were described by Scott (1942) from the Heath formation in Montana.

The most extensive papers on upper Mississippian conodonts that use the form classification describe faunas from the Barnett formation of Texas and the Mississippian portion of the Caney shale in Oklahoma. Conodonts from the Pella beds of Iowa have been described by Youngquist and Miller (1949), and Hass (1950) studied the lower part of the Stanley shale in Arkansas and adjacent Oklahoma. He found the Stanley conodonts to be conspecific with those of the Barnett formation's upper faunal zone and with the Caney shale fauna of Branson and Mehl. Accordingly he correlated parts of the lower Stanley with the Barnett and Caney formations. More recently Hass (1954) listed a conodont fauna from the subsurface of northeastern Mississippi that contained species much the same as those in the Barnett.

Branson and Mehl (1941) described conodonts from a single zone in the Caney shales of Oklahoma "as a start to building up a zonal distribution of the conodonts" in these shales (p. 167). The authors state: "The inference, then, is that the fauna described in this paper belongs in the Upper Mississippian (Chester Group). . . . We anticipate that additional conodont collections from the Mississippian Caney and the Upper Mississippian of other regions will establish this correlation" (p. 168, 169). The evidence of the present paper seems to confirm their evaluation.

Of the eleven genera from the Caney zone and the fourteen type-Chester genera, nine are common to both. *Gnathodus,* present in both, is found only in the Paint Creek formation of the type Chester area. The remaining common genera range from Renault

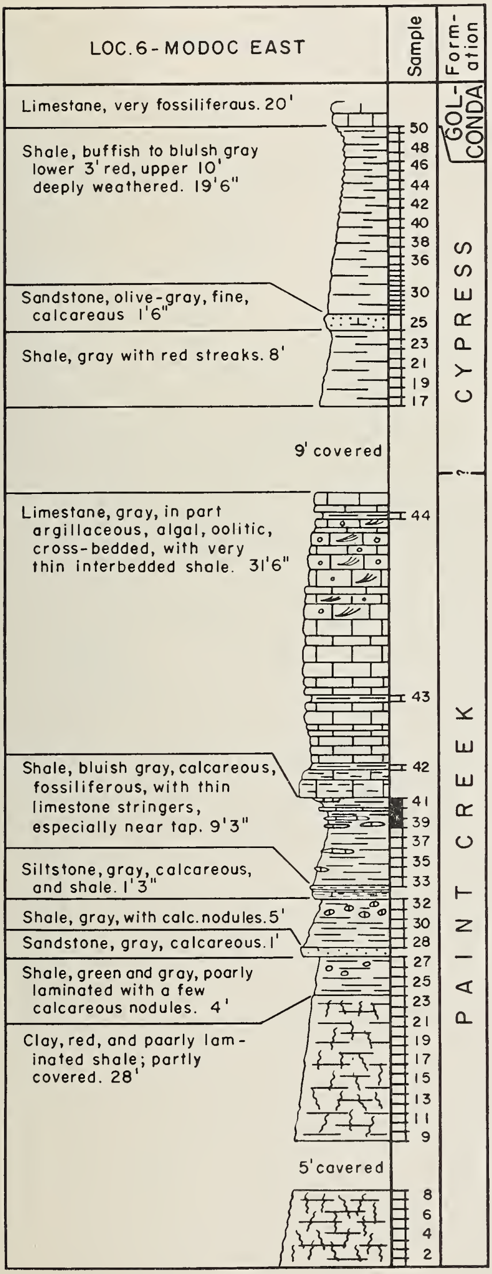


Fig. 9.—Modoc East, locality 6. Outcrops 1000 to 2500 feet above mouth of second ravine about 1.4 miles southeast of Modoc, NW¼ sec. 5 (extended), T. 6 S., R. 8 W., Renault quadrangle, Randolph County, Illinois.

to Kinkaid, inclusive, in the type Chester. Two of the genera found only in the Illinois area are limited to a portion of the series.

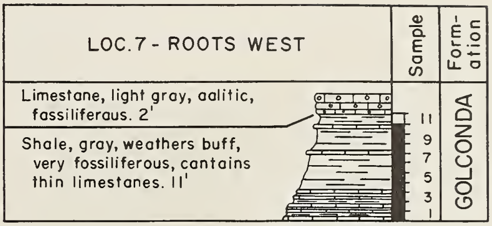


Fig. 10.—Roots West, locality 7. Roadcut and ditch about two-thirds of the way up the hill, 0.6 mile west-northwest of Roots on blacktop road to Ruma, SW¼ SE¼ sec. 10 (extended), T. 6 S., R. 8 W., Baldwin quadrangle, Randolph County, Illinois.

These are *Cladognathus,* found only in the Glen Dean and younger formations, and *Subbryantodus,* found in the Glen Dean and Menard formations. The Chester polygnathid fragments are all from the Renault formation. The absence of *Metalonchodina* in the type Chester presents a puzzle because it has been recognized in numerous upper Mississippian collections, including the Caney. Conspecific and closely related forms also indicate a correlation of the Caney with the type Chester series. It should be noted that *Cavusgnathus cristata,* a Caney form, was present in the Kinkaid microfauna described by Cooper (1947), but it was not found in the present collection. Future studies to establish possible lateral variations of conodonts in the area of the standard Chester sequence should make possible detailed correlation of the Caney zone with the standard formations.

Roundy in 1926 described and illustrated a few conodonts from the Barnett shale. His work was revised and greatly enlarged by Hass (1953). The upper faunal zone of the Barnett shale has been variously treated as Meramec, Chester, and Lower Pennsylvanian. Hass summarized this history and refers to Weller et al. (1948) for a summary of current opinion, that indicated doubt still existed as to the age of the Barnett formation. Subsequently Hass (1954, p. 32) stated, "This zone [upper conodont faunal zone of the Barnett formation] is considered to be of Meramec and possibly also partly of Chester age." The results of the present study tend to substantiate his correlation.

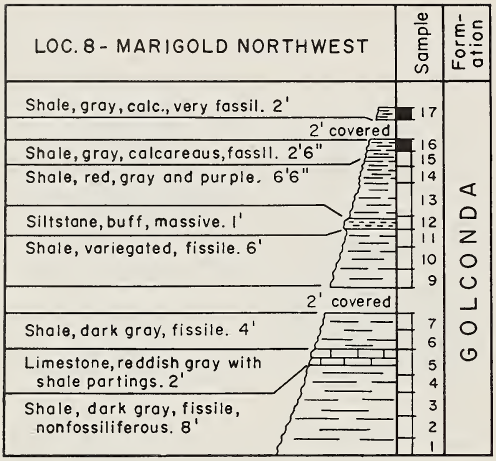


FIG. 11.—Marigold Northwest, locality 8. Bank on southeast side of stream, about 800 feet northeast of farmhouse, ¾ mile northwest of Marigold, NE¼ NW¼ NW¼ sec. 20, T. 5 S., R. 8 W., Renault quadrangle, Randolph County, Illinois.

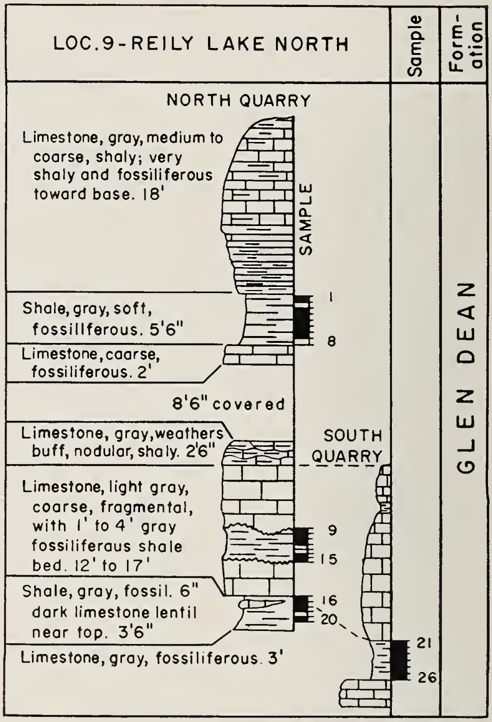


FIG. 12.—Reily Lake North, locality 9. Small quarries in Mississippi Valley bluff about 1.1 miles northwest of Reily Lake, SE¼ SE¼ sec. 24 (extended), T. 6 S., R. 8 W., Chester quadrangle, Randolph County, Illinois.

The generic composition of the Barnett shale fauna is closely similar to the Caney shale fauna of Branson and Mehl, but when each of these faunas is compared to the fauna of the Chester series, the number of genera common to the Barnett and the Chester is found to be less than the number of genera common to the Caney and Chester. The Barnett shale contains four genera not found in the Chester; the Chester has six genera, plus the two "new genera," not present in the Barnett; and six genera are common to both collections. Of these six genera *Cavusgnathus* and *Gnathodus* have the most limited stratigraphic range.

The described conodont fauna that corresponds most closely to that of southwestern Illinois is the one from the type area of the Pella beds of Iowa. In the paper describing this fauna, Youngquist and Miller (1949, p. 618) state, "It can be said that the conodonts we are studying are indicative of either a Meramec or a Chester age for the Pella beds —present lack of published information on conodont faunas of this general age precludes a more nearly precise determination."

All the genera recognized by Youngquist and Miller in the Pella beds are present in the type Chester series. Of the seven species described from the Pella beds three are abundant in the Chester rocks. The remaining identified species and figured specimens from the Pella beds are closely similar to Chester forms. Additional specimens from the Pella further confirm the correlation. Within the Chester, the common species have a long range, but there is a suggestion of correlation with the lower part of the series.

It has been noted above that studies of Chester conodonts have been few and scattered. As future research fills in more details of the stratigraphic sequence and widens the geographic scope, it seems certain that conodonts will provide a basis for sound correlations of widely separated upper Mississippian strata.

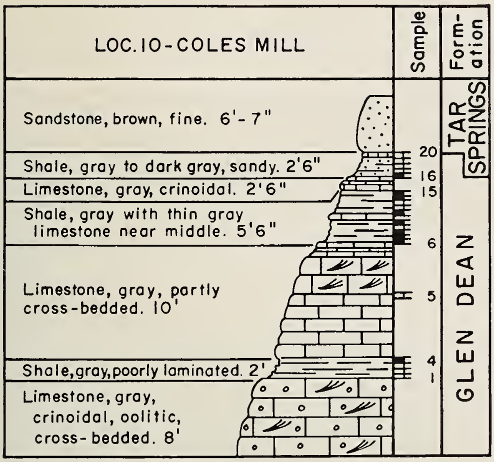


FIG. 13.—Coles Mill, locality 10. Waterfall just above mouth of ravine, east of flour mill at south edge of Chester, W. line NW¼ sec. 30, T. 7 S., R. 6 W., Chester quadrangle, Randolph County, Illinois.

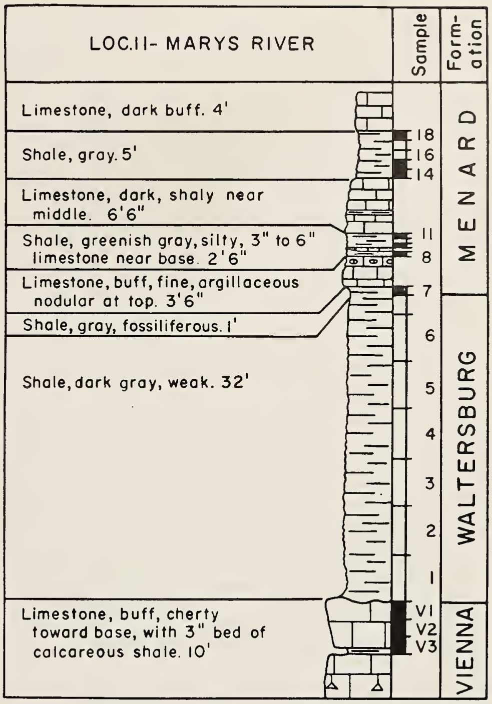


FIG. 14.—Marys River, locality 11. Cut for railroad and road north of mouth of Marys River, NW¼ NE¼ sec. 32, T. 7 S., R. 6 W., Chester quadrangle, Randolph County, Illinois.

SYSTEMATIC DESCRIPTIONS

The type and figured specimens described and illustrated in this paper have been reposited at the Illinois State Geological Survey. Comparative specimens have been reposited at the State University of Iowa and the University of Missouri. Under the heading *Distribution,* only the formations in which that species occurs are listed. For detailed information about the stratigraphic and geographic distribution of each species see table 1.

Genus CAVUSGNATHUS Harris and Hollingsworth, 1933

Type species: *Cavusgnathus alta* Harris and Hollingsworth

Harris and Hollingsworth's original description (1933, p. 200-201) is as follows:

> This genus is erected to include those lanceolate-plated conodonts with no semblance of a median crest in the median oral channel. Outline of plate lanceolate to claviform; oral face of plate with complete, deep, median longitudinal channel without crest and bordered by marginal rims ornamented with denticles, nodes, corrugation, or combinations of the same; posterior bar denticulate.

A revised description by Ellison (1941, p. 125, 126) follows:

> Elongate platform-like teeth with high sides extending parapet-like above a median longitudinal trench; one parapet continued into a free longitudinal blade and connected at the posterior end to opposite parapet whose length is limited by the length of the platform; aboral surface of platform smooth, deeply excavated as a longitudinally elongate laterally asymmetrical, spathodid-like cup, pointed at each end, traversed by a median longitudinal groove which extends to the ends of the platform and along the aboral edge of blade; sides of platform somewhat constricted laterally above the aboral margin to produce a lip-like lateral margin of variable width; oral surface of platform more or less grooved transversely; oral edge of blade denticulate and crenulate.
>
> For purposes of description the blade is directed anteriorly. It is continued posteriorly as the outer edge of platform, the blade parapet. The elevated inner edge of the platform is the inner parapet.

Remarks.—This genus differs from *Idiognathodus* in that the blade of the latter is median. It differs from *Polygnathodella* Harlton in that the latter has no oral trough.

CAVUSGNATHUS CHARACTA Rexroad, n. sp.

Plate 1, figures 1 and 2

Oral View.—Outer parapet convex outward, anterior end offset outward from blade; inner parapet nearly straight except convex at tip; trough straight, deep, with one

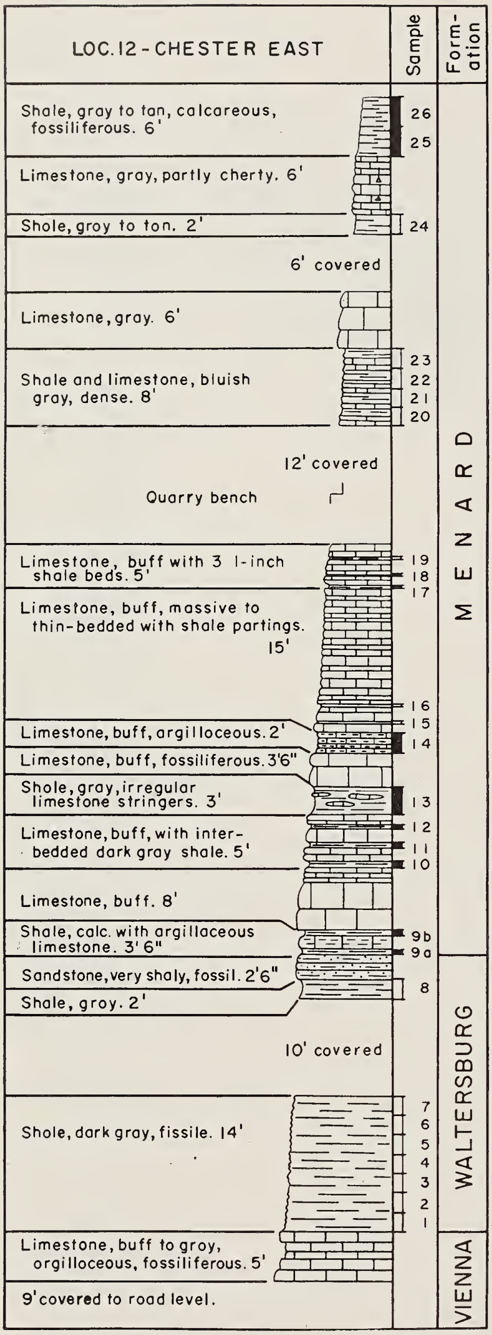


Fig. 15.—Chester East, locality 12. Abandoned high level quarry in Mississippi River bluff opposite sand and gravel docks, about 1.4 miles above mouth of Marys River, SW¼ SE¼ sec. 30, T. 7 S., R. 6 W., Chester quadrangle, Randolph County, Illinois.

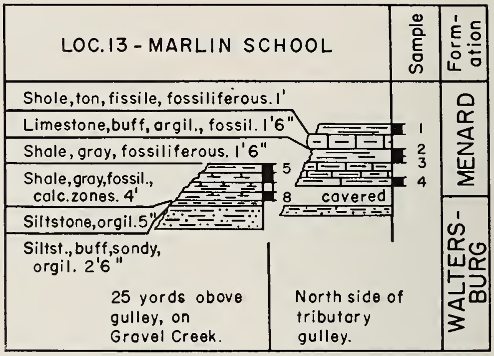


Fig. 16.—Marlin School, locality 13. Outcrops at and near mouth of a tributary gulley entering Gravel Creek from the west, 1500 feet below the bridge on Marlin School road, W. line, SW¼ SE¼ sec. 2, T. 7 S., R. 7 W., Chester quadrangle, Randolph County, Illinois.

to several median nodes commonly present posteriorly; both parapets ornamented with regularly spaced, parallel, transverse ridges obsolescent into trough; blade straight, parallels trough, denticles much compressed laterally.

Lateral view.—Platform high; oral margin of both parapets gently convex, outer one the higher; postero-aboral angle strongly obtuse; distinct notch between outer parapet and blade; blade composed of six to eight denticles, subequal, but generally smaller at anterior, thus presenting low, crenulate, slightly convex oral margin; blade slightly over one-third length of specimen, as much as one-third free; platform constricted above navel; attachment scar present immediately anterior to navel.

Aboral view.—Navel shallow, asymmetric, lanceolate outline, pointed posteriorly, not quite reaching posterior tip, greater flare by inner lateral lip, which extends farther anteriorly than outer lip; navel divided by a groove which extends to both anterior and posterior lips of specimen on otherwise sharp aboral edge.

Distribution.—Renault, Paint Creek formations.

Repository.—Illinois State Geological Survey, 2P1 (holotype) and 2P2, 2P3 (paratypes).

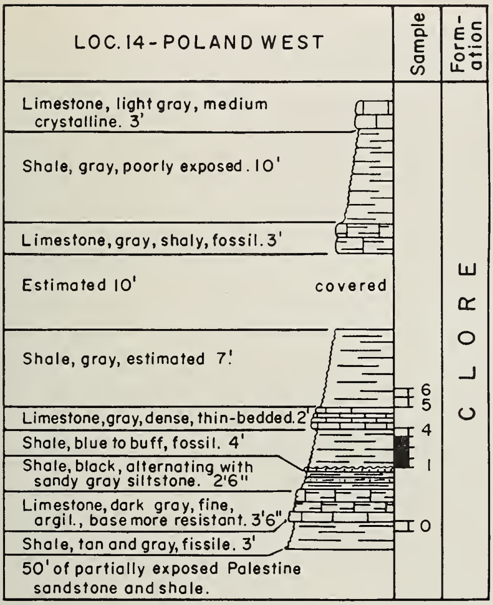


FIG. 17.—Poland West, locality 14. Outcrops in first south-draining gulley west of secondary road, about 0.2 mile north of County Farm—Poland road, near east edge of NW¼ SW¼ sec. 15, T. 7 S., R. 6 W., Chester quadrangle, Randolph County, Illinois.

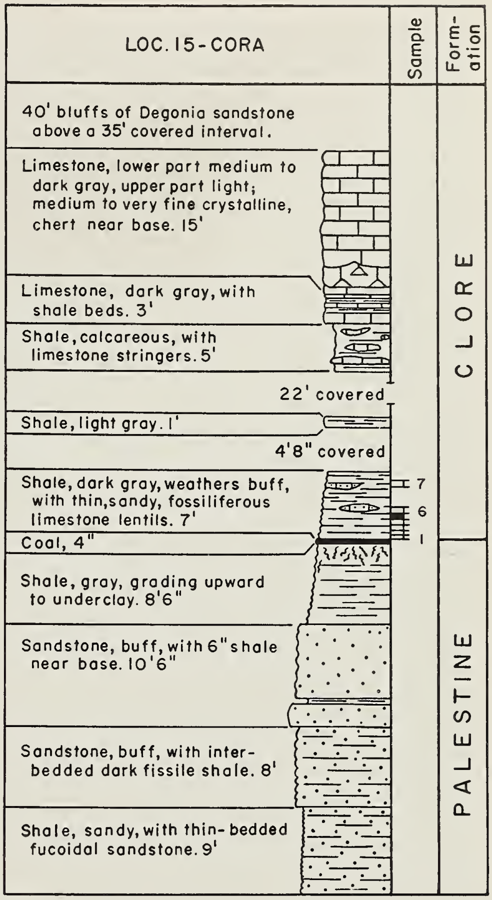


FIG. 18.—Cora, locality 15. Bluff of Mississippi valley just east of valley mouth of Degonia Creek near Cora, SE¼ SW¼ sec. 16, T. 8 S., R. 5 W., Campbell Hill quadrangle, Jackson County, Illinois.

CAVUSGNATHUS CONVEXA Rexroad, n. sp.

Plate 1, figures 3-6

Oral view.—Platform long, narrow; deep trough straight, one or two nodes may be present at posterior end; parapets nearly straight, ornamented with regularly spaced, parallel, transverse ridges becoming obsolescent into the trough; denticles of blade laterally compressed.

Lateral view.—Oral margin of both parapets convex, more convex posteriorly; posterior end rounded; blade composed of four to six denticles fused nearly to apices, blade with regularly convex oral outline, highest at mid-length, length of blade less than one-third length of specimen, a small part free.

Aboral view.—Navel of moderate depth, asymmetric, lanceolate-shaped outline, point reaching posterior tip, inner lip with greater flare; central groove extends anteriorly from navel along otherwise sharp aboral margin.

Distribution.—Renault, Golconda, Glen Dean, Menard, Clore, and Kinkaid formations.

Repository.—Illinois State Geological Survey, 2P4 (holotype) 2P5, 2P6 (paratypes) and 2P7 (figured specimen).

CAVUSGNATHUS UNICORNIS Youngquist and Miller

Plate 1, figure 7

Cavusgnathus unicornis Youngquist and Miller, 1949, Jour. Paleontology, v. 23, no. 6, p. 619, pl. 101, figs. 18-23.

Cavusgnathus cristata Cooper (part), 1947, Jour. Paleontology, v. 21, no. 2, p. 91, figs. 7-10.

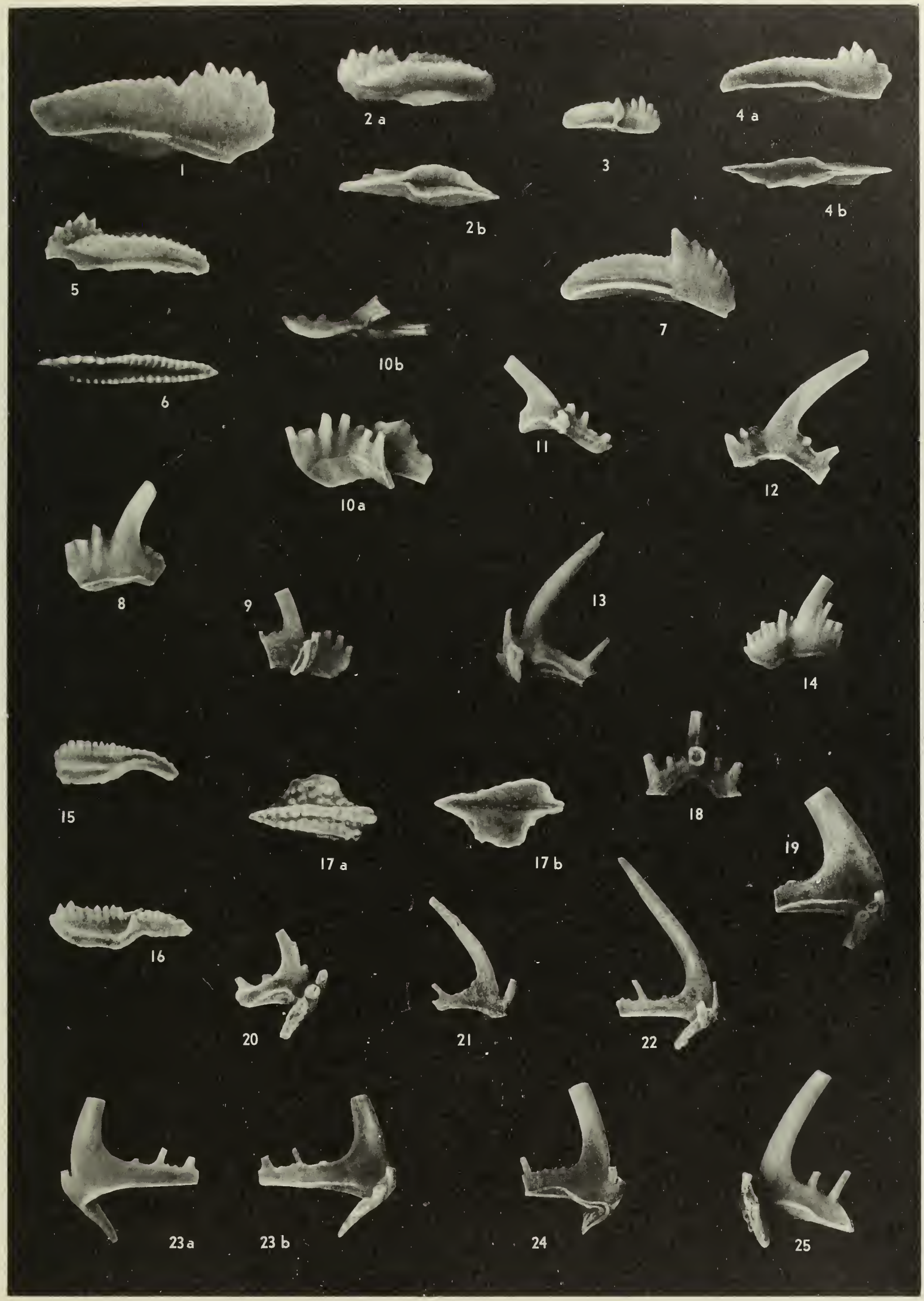
The Chester species is similar in all respects to that from the Pella beds, namely in shape of platform and trough, ornamentation of parapets, configuration of blade with

EXPLANATION OF PLATE 1

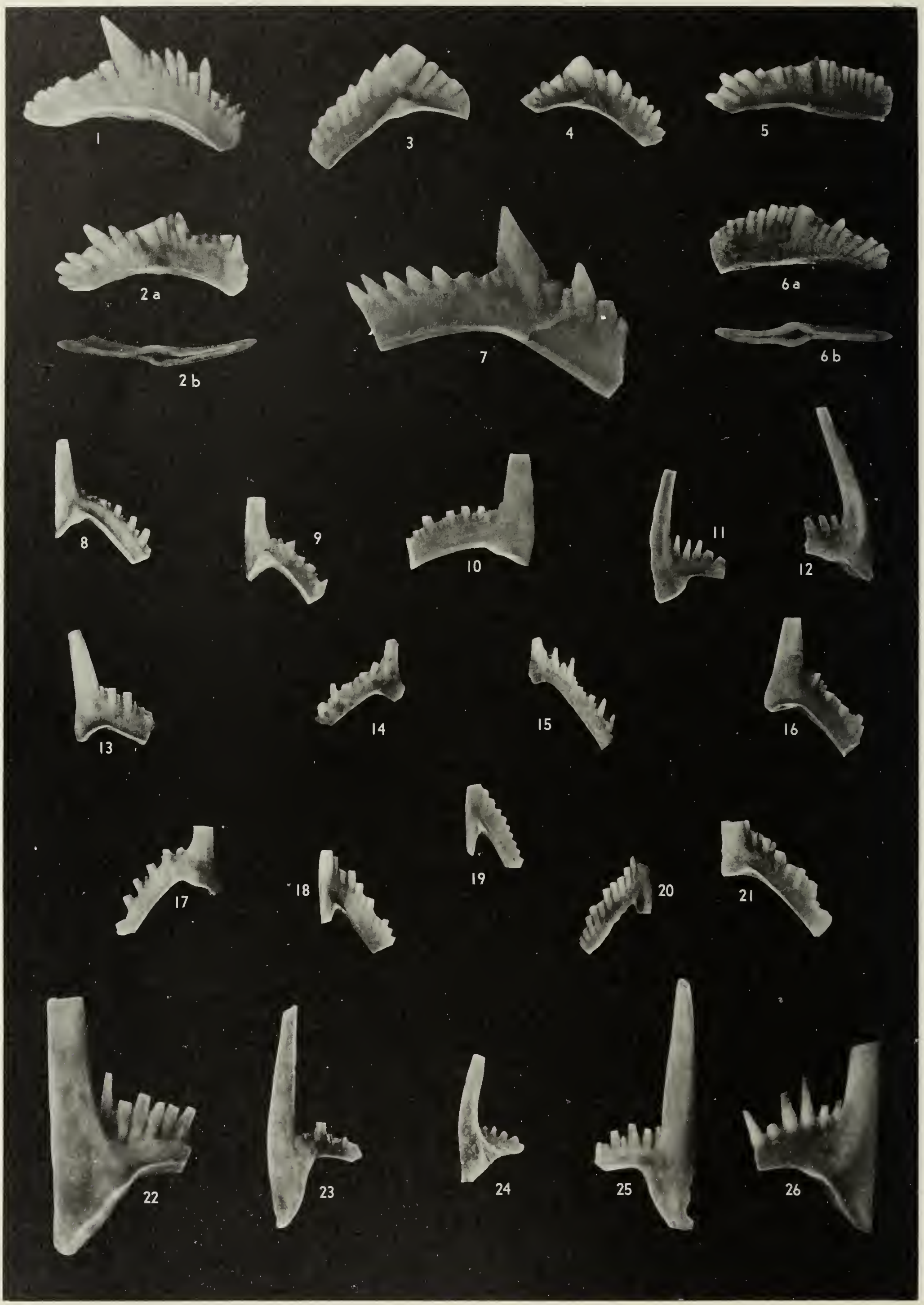
All figures × 40

Numbers in parentheses after explanations refer to locality and sample numbers, for example (2–12) refers to locality 2, sample 12.

Figure	
1, 2.	*Cavusgnathus characta* Rexroad, n. sp.; 1. outer lateral view of a paratype (2–8); 2. inner lateral and aboral views of holotype (2–12).
3–6.	*Cavusgnathus convexa* Rexroad, n. sp.; 3. outer lateral view of a freak (18–4); 4. outer lateral and aboral views of holotype (9–15); 5. inner lateral view of a paratype (10–14); 6. oral view of a paratype (10–10).
7.	*Cavusgnathus unicornis* Youngquist and Miller; outer lateral view (10–6).
8–10.	*Cladognathus prima* Rexroad, n. sp.; 8. outer lateral view of a paratype (10–4); 9. inner lateral view of holotype (10–7); 10. inner lateral and aboral views of a paratype (18–5).
11, 12.	*Cladognathus mehli* Rexroad, n. sp.; 11. inner lateral view of a paratype (10–11); 12. outer lateral view of holotype (10–11).
13.	*Cladognathus* sp. A; inner lateral view (10–8).
14.	*Cladognathus* sp. B; outer lateral view (10–10).
15–17.	*Gnathodus modocensis* Rexroad, n. sp; 15. Outer lateral view of a paratype (5–8); 16. inner lateral view of a paratype (5–1); 17. oral and aboral views of holotype (6–41).
18.	*Hibbardella* sp.; posterior view (10–7).
19.	*Hibbardella* n. sp.?; lateral view (6–41).
20, 21.	*Ligonodina* sp.; 20. inner lateral view (6–41); 21. outer lateral view (2–10).
22, 23.	*Ligonodina obunca* Rexroad, n. sp.; 22. inner lateral view of holotype (6–40); 23. outer and inner lateral views of a paratype (10–8).
24, 25.	*Ligonodina hamata* Rexroad, n. sp.; 24. outer lateral view of a paratype (17–4); 25. inner lateral view of holotype (10–14).



Rexroad, Chester Conodonts



Rexroad, Chester Conodonts

EXPLANATION OF PLATE 2

All figures × 40

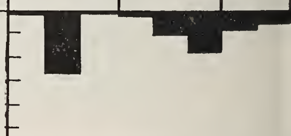
Numbers in parentheses after explanations refer to locality and sample numbers, for example, (10–11) refers to locality 10, sample 11.

Figure	
1, 2.	*Ozarkodina compressa* Rexroad, n. sp.; 1. outer lateral view of a paratype (10–11); 2. inner lateral and aboral views of holotype (10–6).
3, 4.	*Ozarkodina? bella* Rexroad, n. sp.; outer and inner lateral views of cotypes (6–40).
5, 6.	*Ozarkodina recta* Rexroad, n. sp.; 5. inner lateral view of holotype (2–9); 6. lateral view of paratype (6–40).
7.	*Ozarkodina roundyi* (Hass); inner lateral view (10–10).
8, 9, 14.	*Neoprioniodus loxus* Rexroad, n. sp.; 8. inner lateral view (10–6); 9. inner lateral view of holotype (10–11); 14. outer lateral view of a paratype (8–17).
10.	*Neoprioniodus varians* Branson and Mehl; inner lateral view (10–4).
11, 12.	*Neoprioniodus striatus* Rexroad, n. sp.; 11. inner lateral view of holotype (17–4); 12. outer lateral view of paratype (2–5).
13, 16.	*Neoprioniodus tennuis* Rexroad, n. sp.; 13. outer lateral view of a paratype (16–30); 16. inner lateral view of holotype (10–11).
15, 21.	*Neoprioniodus epemoebus* Rexroad, n. sp.; 15. outer lateral view of paratype (6–40); 21. inner lateral view of holotype (12–13b).
17.	*Neoprioniodus* sp. A, inner lateral view (4–4).
18–20.	*Neoprioniodus camurus* Rexroad, n. sp.; 18. inner lateral view of holotype (10-10); 19. inner lateral view of a paratype (10–11); 20. outer lateral view of a paratype (18–2).
22, 26.	*Neoprioniodus scitulus* Branson and Mehl; 22. inner lateral view (11–2); 26. outer lateral view (8–16).
23, 25.	*Neoprioniodus erectus* Rexroad, n. sp.; inner and outer lateral views of cotypes (2–7).
24.	*Neoprioniodus* sp. B; inner lateral view (6–39).

TABLE 1. - STRATIGRAPHIC OCC

Collecting lo

Formation	Renault			Paint Creek			Golconda	
Locality	1	2	3	4	5	6	7	8
Sample								
Cavusgnathus characta	–	x	–	–	–	x	–	–
convexa	–	x	–	–	–	–	x	x
unicornis	–	x	–	x	x	x	x	x
Cladognathus prima	–	–	–	–	–	–	–	–
mehli	–	–	–	–	–	–	–	–
sp. A	–	–	–	–	–	–	–	–
sp. B	–	–	–	–	–	–	–	–
Gnathodus modocensis	–	–	–	–	x	x	–	–
Hibbardella sp.	–	–	–	–	–	–	–	–
n.sp.	–	x	–	–	–	x	x	–
Hindeodella sp.	x	x	x	x	x	x	x	x
Ligonodina hamata	–	x	–	x	x	x	x	–
obunca	–	x	x	–	x	x	–	x
sp.	–	x	–	x	x	x	x	–
Ozarkodina compressa	–	–	–	–	–	–	x	x
recta	–	x	–	–	–	x	–	–
roundyi	–	–	–	–	–	–	–	–
?bella	–	x	–	–	–	x	–	–
Neoprioniodus camurus	–	x	–	–	–	–	x	–
epemoebus	–	–	–	–	–	x	x	–
erectus	–	x	–	–	–	–	–	–
loxus	–	x	–	–	–	x	x	–
scitulus	x	x	x	x	–	x	x	x
striatus	–	x	–	–	–	x	x	–
tenuis	–	x	–	x	–	x	x	–
varians	–	–	–	–	x	x	–	–
sp. A	–	–	–	x	–	–	–	–
sp. B	–	–	–	–	–	x	–	–
Spathognathodus campbelli	–	x	–	x	x	x	x	–
cf. commutatus	–	x	–	–	–	x	–	–
cristula	–	x	–	x	–	–	x	–
spiculus	–	x	–	–	–	x	x	x
sp. A	–	–	–	–	–	–	–	–
sp. B	–	–	–	–	–	–	–	–
Subbryantodus stipans	–	–	–	–	–	–	–	–
sp.	–	–	–	–	–	–	–	–
Synprioniodina sp.	–	x	–	–	–	–	–	–
Trichonodella fragilis	–	x	–	–	–	x	x	–
imperfecta	–	x	–	–	–	–	–	–
Polygnathids	x	x	–	–	–	–	–	–
New genus?	–	x	–	x	–	x	x	x
Genus indeterminate	–	x	–	x	x	x	x	x



Sample numbers such as $\frac{1}{7}$ refer to samples 1 through 7. Prec
samples are shown on the outcrop diagrams (figs. 4-21).

ENCE OF CONODONTS IN THE CHESTER SERIES

ties shown in figure 1

Glen Dean					Vienna	Menard						Clore				Kinkaid	
9			10		11	11		12			13	14	15	16		17	18
9/15	16/20	21/26	1/4	6/16		7/13	14/18	9/16	17/19	25/26				1/5	24/31		
–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
x	x	–	x	x	–	–	x	x	x	–	x	–	–	–	–	x	x
–	x	x	x	x	–	x	x	x	x	x	x	–	–	x	–	x	x
–	–	–	x	x	–	x	–	x	–	x	–	–	–	x	–	x	x
–	–	–	–	x	–	–	–	–	–	–	–	–	–	–	–	–	–
–	–	–	–	x	–	–	–	–	–	–	–	–	–	–	–	–	–
–	–	–	–	x	–	–	–	–	–	–	–	–	–	–	–	–	–
–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
–	–	–	–	x	–	–	–	–	–	–	–	–	–	–	–	–	–
–	x	–	x	x	–	x	–	x	x	–	–	x	–	x	x	–	x
x	x	–	x	x	x	x	x	x	–	x	x	x	x	x	x	x	x
–	–	–	–	x	–	x	x	x	–	–	x	x	–	x	x	x	x
–	–	–	x	x	–	–	–	–	–	–	–	–	–	–	–	–	–
–	–	x	–	x	–	x	–	x	–	–	–	–	–	–	–	–	–
–	x	–	x	x	–	x	–	x	–	–	–	–	–	–	–	–	x
–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
–	–	–	–	x	–	–	–	–	–	–	–	–	–	–	–	–	–
–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
–	–	–	x	x	–	–	x	–	–	–	–	–	–	–	–	–	x
–	–	–	–	x	–	–	–	x	–	–	–	–	–	–	–	–	–
–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
–	–	x	–	x	–	x	–	x	–	–	–	–	–	–	–	–	–
–	x	–	x	x	–	x	x	x	x	x	x	–	–	x	x	x	x
–	–	–	x	x	–	x	x	x	–	–	–	–	–	–	–	–	x
–	–	x	x	x	–	x	x	x	–	–	–	–	–	–	x	–	x
–	–	–	x	x	–	–	–	–	–	–	–	–	–	x	–	–	–
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–	–	–	x	x	–	–	–	–	x	–	–	–	–	x	x	–	–
x	x	x	x	x	–	x	x	x	x	x	x	x	x	x	–	x	–
–	–	–	–	–	–	–	–	x	–	–	–	–	–	–	–	–	–
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–	–	–	–	x	–	x	–	x	–	–	–	–	–	–	–	–	–
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–	x	x	x	x	–	x	x	x	–	x	x	–	–	x	–	x	x
–	x	x	x	x	–	–	x	x	–	x	–	–	–	x	–	x	x

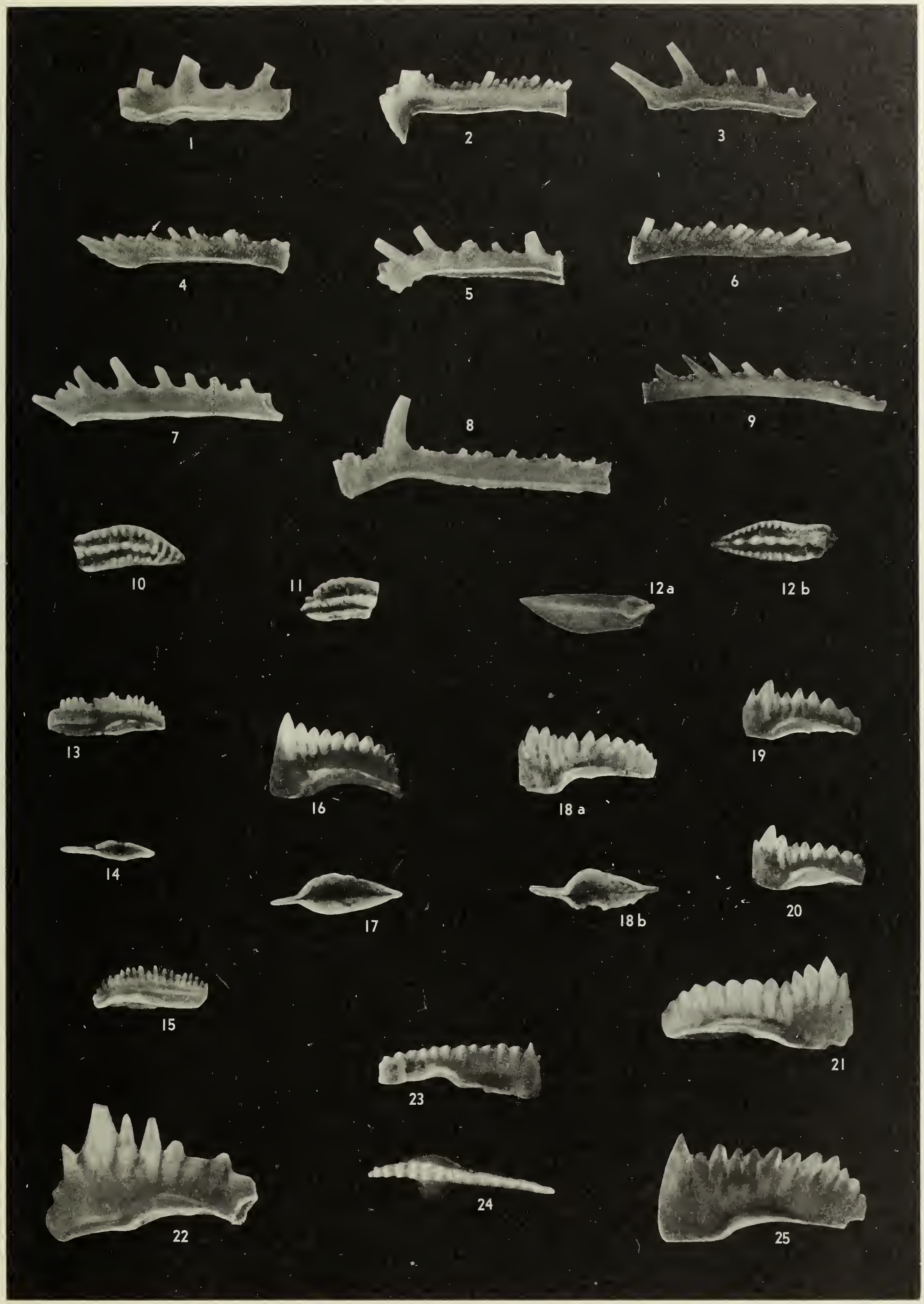
stratigraphic positions of

EXPLANATION OF PLATE 3

All figures × 40

Numbers in parentheses after explanations refer to locality and sample numbers, for example (11–16) refers to locality 11, sample 16.

Figure	
1–9.	*Hindeodella* spp.; lateral views (11–13, 18–2, 11–8, 10–11, 11–13, 6–39, 10–8, 10–6, 10–7, respectively).
10–12.	*Polygnathids*; 10. oral view (2–12); 11. oral view (8–12); 12. aboral and oral views (2–14).
13–15.	*Spathognathodus campbelli* Rexroad, n. sp.; 13. inner lateral view of a paratype (2–18u); 14. aboral view (10–14); 15. outer lateral view of holotype (5–8).
16, 17.	*Spathognathodus cristula* Youngquist and Miller; 16. inner lateral view (10–6); 17. aboral view (10–6).
18–21.	*Spathognathodus spiculus* Youngquist and Miller; 18. lateral and aboral views (6–40); 19–21. lateral views (8–17, 6–40, respectively).
22.	*Spathognathodus* sp. B; inner lateral view (12–9b).
23, 24.	*Spathognathodus* cf. *S. commutatus* Branson and Mehl; 23. inner lateral view (2–11); 24. oral view (2–2).
25.	*Spathognathodus* sp. A; lateral view (12–14).



Rexroad, Chester Conodonts

Rexroad, Chester Conodonts

EXPLANATION OF PLATE 4

All figures × 40

Numbers in parentheses after explanations refer to locality and sample number, for example (10–6) refers to locality 10, sample 6.

FIGURE

1. *Subbryantodus stipens* Rexroad, n. sp.; inner lateral and aboral views of holotype (10–6).

2. *Subbryantodus* sp.; inner lateral view (10–4).

3. *Synprioniodina* sp.; inner lateral view (2–12).

4, 5. *Trichonodella imperfecta* Rexroad, n. sp.; posterior and anterior views of cotypes (18–4).

6, 7. *Trichonodella fragilis* Rexroad, n. sp.; 6. anterior and lateral views of holotype (6–39); 7. lateral view (18–7).

8–13. New genus? 8–10. posterior? views (2–14, 6–40, 10–6, respectively); 11–13. aboral views (10–6, 6–41, respectively).

14–18. Indeterminate fragments; (10–6, 1–17, 6–41, 6–40, 2–10, respectively).

19–22. Genus indeterminate; 19. postero-lateral view (6–41); 20. anterior view (4–4); 21. posterior view (6–40); 22. postero-lateral view (6–40).

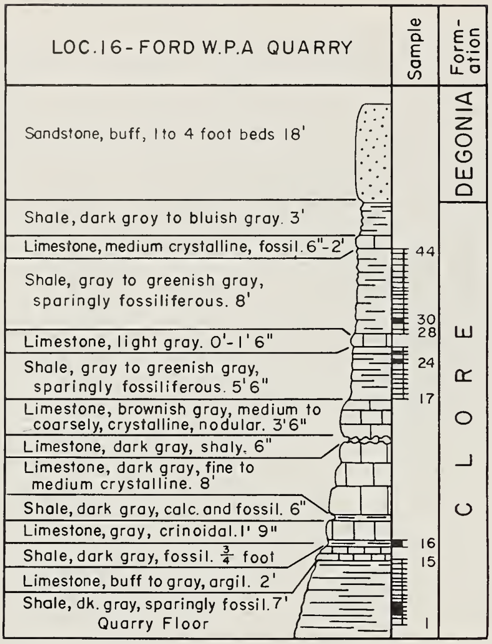


Fig. 19.—Ford W.P.A. quarry, locality 16. Small abandoned quarry in Mississippi River bluff above state highway 3, about 1.3 miles southeast of Marys River bridge, NW¼ SE¼ sec. 33, T. 7 S., R. 6 W., Chester quadrangle, Randolph County, Illinois.

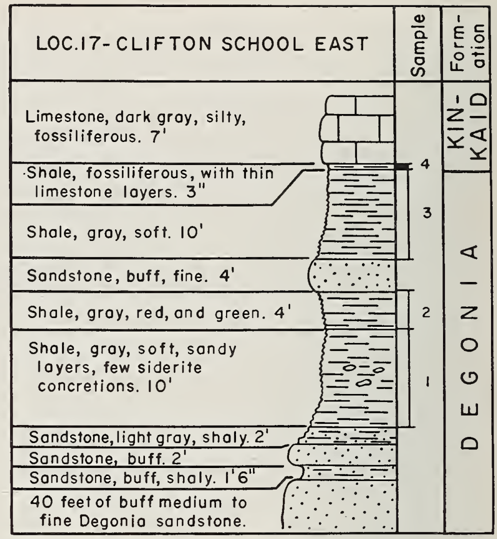


Fig. 20.—Clifton School East, locality 17. Outcrops on east branch of gulley about 1500 feet above fork at Clifton School, two miles northeast of Rockwood, N½ SW¼ sec. 1, T. 8 S., R. 6 W., Campbell Hill quadrangle, Randolph County, Illinois.

larger denticle posterior, and shape and proportions of navel. The blade is commonly more than one-third total length of specimen with only a small part free.

Distribution.—Renault, Paint Creek, Golconda, Glen Dean, Menard, Clore, and Kinkaid formations.

Repository.—Illinois State Geological Survey, 2P8 (figured specimen) and 2P9, 2P10 (unfigured specimens).

Genus Cladognathus, n. gen.

Type species: *Cladognathus prima* Rexroad, n.sp.

Complex dental unit. Posterior bar usually moderately long, thin, denticulate, and slightly arched; denticles of bar commonly discrete, large and small denticles alternating; posterior bar terminated anteriorly by recurved fang. Anterior to the fang are two denticulate processes. One is directed laterally and somewhat downward and backward, an inner lateral process. Usually the proximal denticle of this process is the denticle immediately anterior to the fang. The other process, the anterior process, is directed anteriorly and may continue in the direction of the posterior bar or may incline somewhat outward. Aborally the posterior bar, inner lateral process, and generally the anterior process are medially grooved, the groove enlarging at the juncture of the posterior bar and inner lateral process.

Cladognathus is closely related in form to *Ligonodina* and *Hindeodella,* two genera between which there are transitional forms. Affinities of *Cladognathus* to *Ligonodina,* or perhaps to a ligonodinid transitional with *Hindeodella,* seem most probable. The inner lateral process of *Cladognathus* seems to correspond to the inner lateral process or anticusp of *Ligonodina,* and the anterior process of *Cladognathus* apparently arises from the inner lateral process. It is the development of the anterior process that sets the genus apart from *Ligonodina.*

Cladognathus prima Rexroad, n. sp.

Plate 1, figures 8-10

Posterior bar moderately long, thin, somewhat arched and bowed, bearing discrete, rounded denticles with several small ones al-

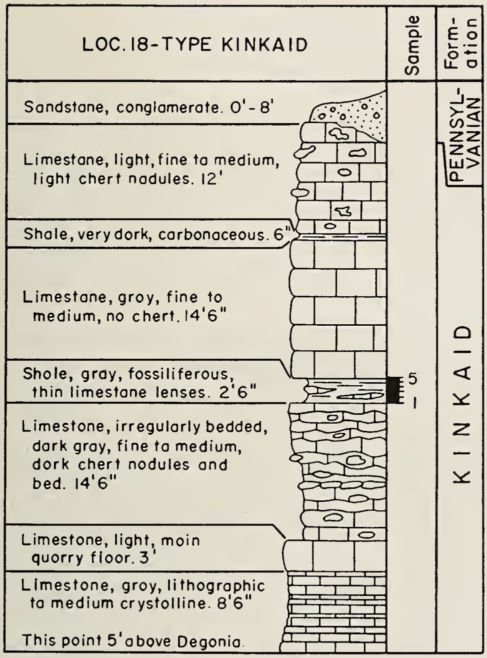


Fig. 21.—Type Kinkaid, locality 18. MacRow, J. R. Giffin or Cromwell quarry on north bank of Kinkaid Creek, SE¼ NW¼ NW¼ sec. 6, T. 8 S., R. 4 W., Campbell Hill quadrangle, Jackson County, Illinois.

ternating with each larger denticle; germ denticles may be visible; attachment scar on anterior portion of inner-lateral face, and in some cases also on outer-lateral face, in which case it is continued anteriorly on the outer-lateral face of anterior process; aboral edge medially grooved, slightly broadened anteriorly, and here may be twisted slightly inward. Fang long, slender, laterally compressed, but rounded fore and aft, recurved. Inner lateral process arises anterior to fang, is directed inward, somewhat backward, and downward; aboral margin medially grooved; proximal denticle the largest, rounded except for faint sharpening in plane of process, on some specimens minute denticle between it and fang; remaining denticles discrete, rounded, slightly recurved, each arising from single germ denticle. Anterior process deep, essentially continues the direction of the posterior bar, and aboral margin continues arch of bar; bears two, three, or four rounded discrete denticles, anterior-most varying in degree of development, posterior denticles erect or recurved. Commonly continuous attachment scar present on inner lateral face of anterior process and anterior face of inner lateral process. Aborally, minute pit at posterior side of juncture of bar and lateral process.

Distribution.—Glen Dean, Menard, Clore, and Kinkaid formations.

Repository.—Illinois State Geological Survey, 2P11 (holotype) and 2P12, 2P13, 2P14 (paratypes).

Cladognathus mehli Rexroad, n. sp.

Plate 1, figures 11 and 12

Posterior bar of moderate length, arched, bearing discrete denticles, marked attachment scar on anterior part of inner lateral face with aboral margin visible here showing medial groove. Fang recurved, laterally compressed. Inner lateral process projects inward, backward, and downward; denticles discrete, rounded, recurved, proximal denticle anterior to fang but inward. Proximal denticle of anterior process anterior to and outward from first denticle of inner lateral process; anterior process carries arch of posterior bar sharply downward and is inclined outward about 15° to 20°; process bears two to four discrete, rounded denticles. Inner face of anterior process and anterior face of inner lateral process form gently convex surface. Both processes, as well as bar, medially grooved aborally.

Distribution.—Glen Dean formation.

Repository.—Illinois State Geological Survey, 2P15 (holotype), and 2P16, 2P17 (paratypes).

Cladognathus sp. A

Plate 1, figure 13

This single specimen with a broken posterior bar and inner lateral process appears to be a transition from *Ligonodina.* The anterior process is very short, bears a single, node-like denticle, and makes an angle of about 40° outward from the direction of the posterior bar. The anterior process is apparently an outpushing from the inner lateral process of a specimen that in all other respects is like a typical *Ligonodina.*

Distribution.—Glen Dean formation.

Repository.—Illinois State Geological Survey, 2P18 (figured specimen).

CLADOGNATHUS sp. B

Plate 1, figure 14

The general form of this single, badly broken fragment is similar to that of *Cladognathus prima.* It differs principally in that the six denticles of the anterior process and those of the posterior bar are fused nearly to their apices, resulting in a deep process and bar.

Distribution.—Glen Dean formation.

Repository.—Illinois State Geological Survey, 2P19 (figured specimen).

Genus GNATHODUS Pander, 1856

Type species: *Gnathodus mosquensis* Pander, 1856

Pander's original description (1856, p. 33-34):

In den Mergeln, der untersten Schichten des Bergkalks im Tulaschen und der höheren des Moskauschen Gouvernements kommen wohlerhaltene kieferartige Ueberreste vor, die sich durch ihre Gestalt und die Beschaffenheit ihrer Basis von den bis jetzt beschriebenen unterscheiden, durch die mikroscopische Structur aber sich eng an sie anschliessen. Auf einer hohen, aus doppelten Wänden bestehenden, schmalen Platte, erheben sich, in einer Reihe, kleine Zähnchen und geben dieser das Ansehen, als wenn sie von einem gezähnten Rande begrenzt werde. Nach unten gehen diese Platten auf der einen Seite stark auseinander und bilden eine Höhle, während sie auf der entgegengesetzten noch aneinander bleiben. Diese Höhle, welche die Pulphöle darstellt, verlängert sich seitwärts hinein und giebt, wie zu vermuthen ist, für jedes Zähnchen einen hinaufsteigenden Fortsatz ab.

A revised description by Branson and Mehl (1938, p. 144):

Jaw pieces consisting of a thin straight or slightly curved, spathodus-like blade which at the posterior end is expanded into a more or less hemispherical, thin-walled cup, opening aborally; the blade extending across the oral surface of the cup as a low nodose or denticulate carina that terminates on the cup or a short distance behind it; oral edge of blade sharply crenulate through the growth of laterally compressed, partly fused denticles; oral surface of cup ornamented by nodes that tend to align themselves into ridges which typically radiate from the center of the cup.

Orientation.—For purposes of description the cup is called posterior. In forms with curved axes the concavity is toward the inner side. This seems to correspond to a less expanded cup on the inner side in markedly asymmetrical forms. The greater lateral extension of the cup marks the outer side and should take precedence over curved axes orientations that do not agree with the above.

Remarks.—Although the tendency toward radial ornamentation is not evident in all the gnathodids this character and the nearly equal cross diameters of the cup seem to be the most trustworthy means of separating the group from the less typical streptognathodids which they resemble, and some of the highly modified spathodids which have posteriorly placed, expanded navels and accessory denticles on the expansion at one side of the blade.

GNATHODUS MODOCENSIS [redacted] Rexroad, n. sp.

Plate 1, figures 15-17

Oral view.—Axis essentially straight; narrow, parapet-like inner side of platform parallels carina, except that both curve slightly to unite in a point at the posterior end of specimen, both range in length up to, but generally less than, one-half length of specimen; inner margin bears single row of nodes and is set off from carina by straight, narrow trough; outer side of platform sub-rectangular in outline, but expanded anteriorly; nodes on upper surface irregularly disposed to longitudinally linearly arranged.

Lateral view.—Carina strongly downcurved posteriorly, denticles broad, low, nodose; blade highest near anterior end, decreases regularly in height posteriorly; denticles about nine to twelve, laterally compressed, fused nearly to apices; anterior end of blade convex, aboral edge straight.

Inner lateral view.—Inner margin of platform about same height as carina; anteriorly it terminates sharply along a line inclined about 80° posteriorly (using line of aboral edge of blade as reference); face rounded, laterally flaring lip along aboral margin; aboral profile concave.

Outer lateral view.—Shallow outer lateral platform unites with carina at about mid-height of blade, aboral profile concave.

Aboral view.—Outline of cup asymmetric and in shape the same as oral view, apex of cup near anterior end, marked groove extends along otherwise sharp edge of blade to its anterior end.

This species closely resembles *Gnathodus bilineatus* (Roundy). It differs chiefly in that the outer margin of the platform is straight, parapet-like, and is separated from the carina, which it very nearly parallels, by a marked trough.

Distribution.—Paint Creek formation.

Repository.—Illinois State Geological Survey, 2P20 (holotype) and 2P21, 2P22, 2P23 (paratypes).

Genus HIBBARDELLA Bassler, 1925

Type species: *Hibbardella angulata* Hinde

Bassler's original description (1925, p. 219):

Anterior and posterior ends equally developed, the tooth being bilaterally symmetrical and the main cusp erect and enormously developed.

Branson and Mehl (1940, p. 175, 176) state:

The generic description of *Hibbardella* by Ulrich and Bassler was based on the natural assumption that it is a simple bilaterally symmetrical arch with discrete limb denticles and an exceptionally large denticle at the apex. [The specimens originally studied were found on the bedding planes of hard, fissile shales, so that any projection normal to the plane of the arch would be either broken off by splitting or concealed beneath the specimen.]

Revised description of Hibbardella:

Highly arched bar-like teeth, bilaterally symmetrical, with limbs of equal length that bear discrete erect or recurved denticles, an erect or recurved denticle of large size at the apex of the arch; a bar bearing discrete denticles extending back from the base of the apical denticle normal to the plane of the arch; without conspicuous excavation beneath the apex of the arch at the union of the arch limbs and the posterior bar.

Remarks.—This genus resembles closely *Trichognathus,* differing chiefly in that the latter is deeply excavated beneath the apex of the arch at the union of the arch limbs and the posterior bar. In its later development *Hibbardella* may have the posterior bar very much shortened and in some species there is only a vestige of the arch limbs.

HIBBARDELLA sp.

Plate 1, figure 18

A single fragment referred to this genus is figured because it can be easily recognized as distinct from associated forms in spite of the fact that it is broken.

Distribution.—Glen Dean formation.

Repository.—Illinois State Geological Survey, 2P24 (figured specimen).

HIBBARDELLA n. sp.?

Plate 1, figure 19

Lateral bars moderately deep, all incomplete, but probably with four or five discrete denticles each and with spatulate distal ends; denticles long, larger toward distal end of bars; aboral edges of lateral bars thin, grooved, meeting at base of cusp in an acute angle, bars incline 5° to 10° posteriorly; anterior faces convex and inclined posteriorly downward. Cusp large, recurved, elliptical in cross section, sharp edged fore and aft, but increasingly rounded toward tip. Posterior bar stout anteriorly; none complete, but perhaps somewhat extended as thin bar, few denticles or nodes on oral surface, bar thinner in young specimens; marked attachment scars anteriorly in lateral view; aboral margin wedge-shaped with longitudinal groove.

Distribution.—Renault, Paint Creek, Golconda, Glen Dean, Menard, Clore, and Kinkaid formations.

Repository.—Illinois State Geological Survey, 2P25 (figured specimen).

Genus HINDEODELLA Bassler, 1925

Type species: *Hindeodella subtilis* Bassler

Bassler's original description (1925, p. 219):

Bar long and straight, bearing 6 to 8 small denticles in front of the strong, long, main denticle and a long series of small denticles, often alternating behind it.

Branson and Mehl (1933, p. 194) add:

At this time we may add to the generic description by Ulrich and Bassler as follows: Long bar—or somewhat blade-like piece—straight or slightly curved laterally, or arched, or both. Some species with the upper edge laterally sinuous. Anterior end broadly flexed or sharply curved inward in the horizontal plane or slightly bent downward. Posterior end tapered, spatulate, slightly downcurved or recurved beneath the bar. Denticulation consisting of a fang of large size at or somewhat behind the anterior curvature, and closely spaced to articulating, more or less sheathed denticles of appreciably smaller size in front and back of the fang. The smaller denticles usually alternate in size regularly or irregularly with one to several minute denticles between the larger. The aboral side of the bar is sharp, usually without evidence of a longitudinal groove except near a small pit which marks the position of the subterminal fang.

Orientation.—For convenience of description, all units are oriented as though edging the lower jaw with the anterior curvature directed toward the median line. In species where the anterior end is not curved inward, there is more or less lateral flexure of the unit as a whole and the concave side is designated inner side.

The genus is closely related to *Ligonodina* Ulrich and Bassler, differing chiefly in that the anterior end of *Ligonondina* is much more conspicuously downturned and the smaller denticles seldom suggest an arrangement of alternating sizes and are not sheathed.

Hindeodella spp.

Plate 3, figures 1-9

The hindeodellid element in the Chester fauna shows a wide variety of forms in the fragmentary specimens present. Specific references are not justified on the basis of the single complete specimen and the termini of bars, much less on the mid-section of bars. However, representative forms are figured to indicate the nature of the material.

One fragment of a rod-like bar (fig. 9) is similar to the bar of typical hindeodellids except that the denticles, which alternate in size and diminish in size toward the tapered tip of the bar, are inclined in the direction opposite to that expected.

Distribution.—Renault, Paint Creek, Golconda, Glen Dean, Vienna, Menard, Clore, and Kinkaid formations.

Repository.—Illinois State Geological Survey, 2P26-2P34 (figured specimens).

Genus Ligonodina Bassler, 1925

Type species: *Ligonodina pectinata* Bassler

Bassler's original description (1925, p. 218):

[Like *Prioniodus* but] distinguished by the development of a series of sucker-like impressions on the downward extension of the main cusp.

Branson and Mehl's description (1933, p. 48):

Complex dental units consisting of a moderately long straight to down-curved basal bar with aboral side more or less excavated lengthwise, oral surface set with discrete denticles of nearly circular cross section; bar terminated anteriorly by an erect or recurved long stout denticle, typically with circular cross section and with base (aboral surface) more or less excavated; inner side produced strongly downward, in some cases extended to a conspicuous point. Lower inner side bearing a few stout discrete denticles which project inward and downward.

The sucker-like depressions on the downward extension of the main cusp by which Bassler distinguished the genus are the scars left where discrete denticles have been broken away.

Ligonodina hamata Rexroad, n. sp.

Plate 1, figures 24 and 25

Posterior bar long, very thin, nearly straight; aboral margin truncated, medially grooved; groove expands and deepens slightly beneath terminal (sub-terminal) fang where aboral edge is wedge-like; faint outer-lateral lip, attachment scar marks inner face of bar anteriorly; denticles alternate in size, several small denticles between each pair of larger denticles, germ denticles usually visible. Anterior fang long, inclined backward by bend near base, laterally compressed with sharp fore and aft edges. Antero-lateral process short, directed outward, downward, and backward; arises from anterior margin of fang; proximal of three (rarely four) denticles immediately anterior to fang; adjacent denticle may not be completely offset from fang; process deepens distally.

Distribution.—Renault, Paint Creek, Golconda, Glen Dean, Menard, Clore, Kinkaid formations.

Repository.—Illinois State Geological Survey, 2P35 (holotype), 2P36, 2P37 (paratypes).

Ligonodina obunca Rexroad, n. sp.

Plate 1, figures 22 and 23

Posterior bar long, thin, nearly straight, but may be slightly arched; aboral margin of bar truncated, medially grooved, expanded at anterior end; outer lateral lip present; attachment scar may be present toward anterior end of inner face; denticles of bar small, discrete, widely spaced, in some cases smaller ones present between larger. Terminal fang long, slender, recurved with greatest curvature near base, somewhat compressed laterally. In some specimens a very small denticle is present on anterior margin of terminal fang near its base but entirely distinct from denticles of infero-lateral process. Infero-lateral process short, directed inward, backward, and sharply downward; aboral edge medially grooved; process bears three (or rarely four) discrete denticles, the proximal one nearly round in cross section, the distal one compressed in plane of process, distal end of process spatulate.

Distribution.—Renault, Paint Creek, and Glen Dean formations.

Repository.—Illinois State Geological Survey, 2P38 (holotype), 2P39, 2P40, 2P117 (paratypes).

LIGONODINA sp.

Plate 1, figures 20 and 21

Posterior bar thin, aborally truncated and medially grooved, inner lateral attachment scar near anterior end. Terminal (sub-terminal) fang long, thin, laterally compressed, recurved, inclined somewhat inward. An erect, discrete denticle present anterior to terminal fang; it is the first denticle of four or five on the antero-lateral process, which is directed inward, downward, and backward.

Distribution.—Renault, Paint Creek, Golconda, Glen Dean, and Menard formations.

Repository.—Illinois State Geological Survey, 2P41, 2P42 (figured specimens).

Genus NEOPRIONIODUS Rhodes and Müller, 1956

Type species: *Prioniodus conjunctus* Gunnell

Rhodes and Müller's original description (1956, p. 698):

> *Diagnosis.*—Compound conodonts consisting of a denticulated posterior bar, at the anterior end of which a large fang (main cusp) is developed. The base of this fang may or may not extend downward below the level of the bar to form an "anticusp," the anterior edge of which may or may not be denticulated. There is usually a basal cavity below the fang, which may be extended as a shallow groove on the aboral surface of the posterior bar.

Remarks.—Rhodes and Müller have proposed the genus *Neoprioniodus* to include material that by long accepted usage has been referred to *Prioniodus* Pander, but which Lindström (1954, p. 589) excludes from *Prioniodus* by a redefinition of that genus.

Pander's original specimens were fragmental and the description brief, and the redefinition of *Prioniodus* Pander by Branson and Mehl (1933, p. 129) has been commonly accepted. In a subsequent discussion of the genus (1944, p. 241), Branson and Mehl indicate that topotypes of Pander's material show considerable gradational variation and include specimens that fit Lindström's redefinition of *Prioniodus* as well as those Lindström would exclude. However, Branson and Mehl state: "The acceptance of an atypical species as genotype seems less confusing than drastic change in taxonomy."

Although it is not stated, Lindström apparently redefines *Prioniodus* Pander, not because the original types were fragmental, but because he feels the type species and closely similar forms are sufficiently atypical that they belong in a separate genus. Rhodes and Müller (1956, p. 697) accept Lindström's redefinition stating:

> If the redefinition is accepted as valid (and the present writers believe that it should be), it will have the effect of excluding from the genus *Prioniodus* the majority of species previously assigned to it. In any case, the genus as redefined by Lindström cannot be regarded as congeneric with the following proposed new genus [*Neoprioniodus*]. The differences between them are considerable and are easily recognized in complete specimens. Since the stratigraphic range of the two genera is different, the division is also of practical value.

And further:

> The only method of dealing with the many species of *Prioniodus* which are now excluded from the genus by Lindström's redefinition, appears to be to assign them to a new genus [*Neoprioniodus*]. In spite of Branson and Mehl's (1944) suggestion of a gradation between such forms and those with a lateral process (*Prioniodus* s.s.) in topotype specimens of *P. elegans,* the two broad groups appear to be well differentiated in younger faunas.

NEOPRIONIODUS CAMURUS Rexroad, n. sp.

Plate 2, figures 18-20

Posterior bar long, very thin, straight from lateral view, bowed inward with sharp flexure immediately posterior to fang, and bearing about ten to thirteen laterally compressed, sharp-pointed denticles; aboral margin of bar grooved, groove visible from inner lateral but not outer lateral view. Terminal fang laterally compressed, in cross section inner side more convex than outer; from lateral view anterior edge of fang and aboral projection straight with angle between fang and posterior bar about 140° ; from anterior view fang and aboral projection together concave inward; oral termination of fang not known. Aboral projection very long, anterior and posterior margins nearly parallel, termination square; some specimens show slight evidence of suppressed denticles on anterior margin. Seen aborally, pit is minute with asymmetric elliptical outline, inner lateral lip with greater flare; from lateral view in transmitted light, shape of pit is isosceles triangle with short base, one side a direct continuation of aboral margin of bar, the other essentially a continuation of posterior margin of aboral projection.

Four specimens placed in this species vary gradationally in that the posterior bar is somewhat thicker in proportion to the denticles than in the remaining specimens. The four specimens are from the Renault and Paint Creek formations, and the others are from the Golconda, Glen Dean, and Kinkaid formations.

Distribution.—Renault, Paint Creek, Glen Dean, Golconda, and Kinkaid formations.

Repository.—Illinois State Geological Survey, 2P53 (holotype), 2P54, 2P55 (paratypes).

NEOPRIONIODUS EPEMOEBUS Rexroad, n. sp.

Plate 2, figures 15, 21

Bar long, thin, bowed, with sharp inward flexure at juncture with fang, slightly arched, lateral faces flat or nearly so; bar bearing more than twenty laterally compressed denticles, appressed in adult forms, small denticles (commonly two) alternate with large, each tapering sharply to point; aboral margin medially grooved, some specimens twisted to show groove from inner lateral view. Terminal fang incomplete, apparently of moderate length and straight; fang laterally compressed, biconvex, sharp edges fore and aft; base truncated nearly at right angle. Moderately deep pit present, pit subround but asymmetric in outline, inner lateral lip with greater flare; medial groove extends to anterior tip of base, and posteriorly along bar.

Distribution.—Paint Creek and Menard formations.

Repository.—Illinois State Geological Survey, P256 (holotype) and 2P57 (paratype).

NEOPRIONIODUS ERECTUS Rexroad, n. sp.

Plate 2, figures 23, 25

Posterior bar short, thin, arched, bowed inward; denticles probably seven or eight in number, slightly compressed laterally, free. Terminal fang long, narrow, strongly compressed laterally with sharp edges fore and aft; outer side more convex in cross section; from lateral view anterior margin slightly convex, posterior margin straight; viewed anteriorly fang is concave inward; tip slightly twisted. Aboral projection long, pointed, postero-aboral margin convex, meeting aboral margin of bar at low obtuse angle. Lateral tips of pit not flared, extending from tip of aboral projection onto aboral margin of posterior bar, making the pit exceptionally long and narrow; pit shallow except for small conical inner pit pointed sharply anteriorly and located at juncture of aboral margin of posterior bar with the fang.

P. erectus has an outline almost identical with that of *P. ligo* Hass. However, *P. erectus* lacks the beveled and finely lined characteristics of the aboral portion of the bar and aboral projection of cusp, and it has a long, narrow excavation rather than a small pit with associated aboral grooves.

Distribution.—Renault formation.

Repository.—Illinois State Geological Survey, 2P58 (cotypes, two specimens).

NEOPRIONIODUS LOXUS Rexroad, n. sp.

Plate 2, figures 8, 9, 14

Posterior bar long, slightly arched and bowed, lateral faces rounded, aboral margin truncated, bar bearing short denticles; denticles sub-round in cross section, unequal in size with an irregular alternation of sizes. Terminal fang narrow, moderately long; in cross section greatly convex on inner side, slightly so on outer side, sharp-edged fore and aft; anterior margin in lateral view straight or somewhat concave, in anterior view concave inward. Aboral projection short, sharp; angle of postero-aboral margin with bar obtuse to near 90°. Subapical pit shallow except minute, deep, conical inner pit; pit asymmetric in outline reflecting asymmetry of fang and emphasized by laterally flaring inner lip and flat outer lip. Medial groove present along aboral margin of bar and extending to tip of aboral projection of fang.

Distribution.—Renault, Paint Creek, Golconda, Glen Dean, Menard, and Clore formations.

Repository.—Illinois State Geological Survey, 2P59 (holotype), 2P60, 2P61 (paratypes), and 2P62 (figured specimen).

Neoprioniodus scitulus (Branson and Mehl)

Plate 2, figures 22, 26

Prioniodus scitulus Branson and Mehl, 1940, Denison University Bull. Jour. Sci. Labs., v. XXXV, p. 173, pl. V, figs. 5, 6; Cooper, 1947, Jour. Paleontology, v. 21, no. 2, p. 92, pl. 20, figs. 1-3.

This is the most common species of *Neoprioniodus* in the Chester series. It is somewhat variable, and some specimens are nearly identical with representatives of the same species from the Caney shale. The anterior margin of the fang viewed laterally may be straight or convex, and the depth and thickness of the posterior bar vary. Denticles are slightly to moderately compressed laterally. The young show no attachment scar, but this feature becomes well developed in old specimens.

Distribution.—Renault, Paint Creek, Golconda, Glen Dean, Menard, Clore, and Kinkaid formations.

Repository.—Illinois State Geological Survey, 2P64, 2P63 (figured specimens).

Neoprioniodus striatus Rexroad, n. sp.

Plate 2, figures 11 and 12

Posterior bar thin, shallow, nearly straight, bears four to six laterally compressed denticles, each wider than the one anterior to it; denticles free, of sub-equal length. Terminal fang strongly compressed laterally, sharp-edged, recurved; viewed from anterior, concave inward. Aboral projection large with convex postero-aboral margin; broadly flared lateral lips extend from tip of projection onto aboral margin of bar forming long, narrow excavation with medial groove; small conical, inner pit present at juncture of posterior bar and fang.

Distribution.—Renault, Paint Creek, Golconda, Glen Dean, Menard, Clore, and Kinkaid formations.

Repository.—Illinois State Geological Survey, 2P65 (holotype), 2P66, 2P67 (paratypes).

Neoprioniodus tenuis Rexroad, n. sp.

Plate 2, figures 13, 16

Posterior bar long, thin, moderately deep, somewhat arched and bowed; in cross section outer face nearly straight, inner face convex; appressed, laterally compressed denticles unequal in size, with irregular alternation of small with large. Terminal fang greatly compressed laterally, sharp-edged fore and aft; viewed laterally, posterior margin convex, anterior margin slightly concave except at base and aboral projection; viewed anteriorly, anterior margin of fang and aboral projection is slightly sigmoidal with fang concave inward and aboral projection convex inward. Aboral projection short, sharp, its postero-aboral margin forms an angle with posterior bar ranging from broadly obtuse to near 90°. Apical pit asymmetric in outline, outer side flat, inner side with laterally flaring lip; pointed anterior end of pit extends to tip of aboral projection. Median groove extends posteriorly along narrow aboral margin of bar.

Distribution.—Renault, Paint Creek, Golconda, Glen Dean, Menard, Clore, and Kinkaid formations.

Repository.—Illinois State Geological Survey, 2P68 (holotype) 2P69 (paratype) and 2P70 (paratypes, two specimens).

NEOPRIONIODUS

[redacted] varians (Branson and Mehl)

Plate 2, figure 10

Prioniodus varians Branson and Mehl, 1940, Denison Univ. Bull., Jour. Sci. Labs., v. XXXV, p. 174, pl. V, figs. 7, 8

The Chester specimens, although variable, conform well to the Caney shale forms. Branson and Mehl's thorough description needs no elaboration.

Distribution.—Paint Creek, Golconda, Glen Dean, and Clore formations.

Repository.—Illinois State Geological Survey, 2P71 (figured specimen).

Neoprioniodus sp. A.

Plate 2, figure 17

Posterior bar long, slightly bowed, lateral faces and oral margin rounded; aboral edge medially grooved, shallowly excavated with very narrow, flared, lateral lips; bar bearing seven or more discrete denticles that vary slightly in size and are round in cross section. Terminal fang incomplete; anterior edge sharp, mid-portion concave in lateral view. Aboral projection probably short, sharp, with indications of denticulation on anterior margin. Postero-aboral margin shallowly excavated with pit under base of fang; inner lateral lip greatly flared, outer margin nearly straight.

Only a single specimen was found.

Distribution.—Paint Creek formation.

Repository.—Illinois State Geological Survey, 2P73 (figured specimen).

Neoprioniodus sp. B

Plate 2, figure 24

Posterior bar short, straight, bearing four node-like discrete denticles; bar thick and deep at anterior, tapers sharply to point posteriorly; viewed aborally, bar not set off from remainder of aboral margin of specimen. Entire base viewed aborally, doubly pointed, widest centrally where conical pit is present in otherwise shallowly excavated base, lateral lips not flared. Terminal fang long, recurved; near base almost triangular in cross section with sharp anterior and lateral edges, posterior face slightly convex, antero-lateral faces nearly straight; toward tip cross section modified with sharp edges fore and aft and somewhat convex lateral faces. Aboral projection short, broad, with sharp tip.

Distribution.—Paint Creek formation.

Repository.—Illinois State Geological Survey, 2P74 (figured specimen).

Genus Ozarkodina Branson and Mehl, 1933

Type species: *Ozarkodina typica* Branson and Mehl

Branson and Mehl's original description (1933, p. 51):

> Compound dental units consisting of a thin, blade-like, denticulate arched bar with a denticle of superior size near mid-length and approximately an equal number of parallel subequal smaller denticles on either side of it. Denticles laterally compressed, sharp-edged, more or less confluent or actually sheathed. Base excavated beneath large denticle.

Ozarkodina compressa Rexroad, n sp.

Plate 2, figures 1 and 2

Arched and bowed, thin, blade-like unit with posterior limb commonly the more bowed; anterior limb with nine to eleven fused denticles, slightly compressed laterally; denticles of posterior limb two or three fewer in number and more compressed, inclined strongly posteriorly; denticles vary in size; most arise from single germ denticle. Apical denticle twice width of others, longer, tapers to point, inclined posteriorly. Moderately deep navel, asymmetric elliptical in outline, inner lateral lip only slightly flared, outer lateral lip flared more, but is shorter; longitudinal groove of navel extended to ends of specimen.

Distribution.—Golconda, Glen Dean, Menard, and Kinkaid formations.

Repository.—Illinois State Geological Survey, 2P44 (holotype), 2P45 (paratype).

Ozarkodina recta Rexroad, n. sp.

Plate 2, figures 5 and 6

Blade-like unit, thin, bowing negligible, aboral margin nearly straight. Denticles of anterior limb about ten in number, erect, with short, sharp, free apices; most arise from single germ denticles, few suppressed; denticles of posterior limb about eight in number, strongly compressed laterally, wider and shorter than denticles of anterior limb, inclined strongly posteriorly, increasingly so to the rear. Apical denticle two or three times wider than anterior denticles, tapers to point, inclined somewhat posteriorly, narrows downward because of adjacent suppressed denticles. Sharp aboral edge marked by groove extending from sub-apical pit to anterior end and part way to posterior end of specimen; pit with heavy asymmetric lips only slightly flared. Some specimens show attachment scars in lateral view.

Distribution.—Renault and Paint Creek formations.

Repository.—Illinois State Geological Survey, 2P47 (holotype), 2P48, 2P49, 2P50 (paratypes).

Ozarkodina roundyi (Hass)

Plate 2, figure 7

Subbryantodus roundyi Hass, 1953, U. S. Geol. Survey Prof. Paper 243-F, p. 89, pl. 14, figs. 3-6.

The several fragments of this form present in the Chester series are undoubtedly conspecific with *Subbryantodus roundyi* Hass, which is referred to the genus *Ozarkodina* because of the small sub-apical pit that it possesses in contrast to an elongate excavation.

Distribution.—Glen Dean formation.

Repository.—Illinois State Geological Survey, 2P51 (figured specimen).

Ozarkodina? bella Rexroad, n. sp.

Plate 2, figures 3 and 4

Thin blade-like unit arched and bowed with nearly straight limbs. Anterior limb bears about six to eight laterally compressed denticles, increasing in size posteriorly, fused nearly to apices, and inclined posteriorly. Posterior limb shorter with several fewer laterally compressed denticles that incline posteriorly nearly parallel to apical denticle. Apical denticle twice as wide as other denticles, longer, inclined strongly posteriorly, laterally compressed, and sharp edged. Asymmetrical navel, elliptical in outline, extends almost to posterior tip, outer lateral tip of navel the larger; navel deep near its anterior end with small conical extension upward under apical denticle, remainder shallow; medial groove extends anteriorly along aboral margin of anterior limb.

Distribution.—Renault and Paint Creek formations.

Repository.—Illinois State Geological Survey, 2P52 (cotypes, two specimens).

Genus Spathognathodus Branson and Mehl, 1941

(Spathodus Branson and Mehl, 1933)

Type species: *Spathodus primus* Branson and Mehl

Branson and Mehl's original description (1933, p. 46):

Compound, straight, blade-like dental units with nearly straight aboral margin, and, oral margin curved or straight but highest at or near anterior end. A short lateral expansion near mid-length produces on the otherwise comparatively sharp aboral edge a cup-like excavation or navel, which ranges in shape from slightly elongate antero-posteriorly, through circular, to laterally elongate; either bilaterally symmetrical or asymmetrical in relation to the blade. Oral edge or crest consisting of a single row of "germ denticles," evident in transmitted light, completely sheathed to form a continuous crenulate oral edge. Oral surface of mid-length basal expansion or navel typically smooth but in some species bearing one or a few separate denticles.

Species of this genus with accessory denticles on the oral side of the navel expansion constitute connecting links between typical *Spathodus* and another development in which more or less fused navel denticles produce a denticulated platform on either side, comparable in appearance to *Polygnathus*.

Spathognathodus campbelli Rexroad, n. sp.

Plate 3, figures 13-15

Blade delicate, bowed in posterior two-thirds, composed of about 20 laterally compressed denticles in mature form; denticles subequal in size, each from distinct germ denticle, nearly vertical in anterior half, but tend to incline posteriorly in posterior half.

Lateral view.—Oral margin crenulate, convex, convexity increasing posteriorly; blade distinctly thinner aboral to horizontal line that runs the length of the blade immediately oral to navel; navel deepest near anterior end.

Aboral view.—Length of navel about one-half length of specimen; lateral lips of navel thin; navel curved and asymmetric, posteriorly pointed, extending to rear of specimen, anteriorly less pointed, extended as groove on oral edge of blade; outer lip flared uniformly, inner lip with greatest flare anteriorly.

Specimens very similar in gross features but too poorly represented for differentiation are present in the Chester. They appear to differ from *S. campbelli* in having a shorter blade and more uniformly convex oral margin.

Distribution.—Renault, Paint Creek, Golconda, Glen Dean, Menard, Clore, and Kinkaid formations.

Repository.—Illinois State Geological Survey, 2P75 (holotype), 2P76, 2P77 (paratypes), and 2P78 (figured specimen).

Spathognathodus cf. S. commutatus Branson and Mehl

Plate 3, figures 23 and 24

Spathognathodus commutatus, Branson and Mehl, 1941, Jour. Paleontology, v. 15, no. 2, p. 98, pl. 19, figs. 1-4.

The Chester specimens appear to have a thinner lipped, proportionately longer navel, and fewer denticles than do the syntypes from the Pitkin limestone. Otherwise they agree very closely. Variation was noted in the Pitkin specimens by Branson and Mehl, and it is felt that the differences of the Chester specimens do not justify erection of a new species.

Distribution.—Renault and Paint Creek formations.

Repository.—Illinois State Geological Survey, 2P79, 2P80 (figured specimen).

Spathognathodus cristula Youngquist and Miller

Plate 3, figures 16 and 17

Spathognathodus cristula Youngquist and Miller, 1949, Jour. Paleontology, v. 23, no. 6, p. 621, pl. 101, figs. 1-3.

Blade short, very slightly bowed, composed of eight to twelve denticles fused nearly to apices; denticles elliptical in cross section with sharp edges fore and aft, nearly equal in size except posterior two or three which are smaller and anterior-most denticle which is about two times wider and considerably longer than remainder; in lateral view crenulate oral edge slopes posteriorly, sharply so near posterior tip; anterior edge is straight or slightly convex; aboral edge anterior to navel is straight. Navel deepest near anterior and with conical extension pointed strongly anteriorly evident in transmitted light; navel two-thirds to three-fourths length of specimen. Viewed aborally navel has nearly symmetrical, oblong-lanceolate outline; about two to two and one-half times longer than wide with point extending to posterior end of blade; lateral lips thin; navel divided by medial groove that extends to anterior end of blade.

Distribution.—Renault, Paint Creek, Golconda, Glen Dean, Menard, Clore, and Kinkaid formations.

Repository.—Illinois State Geological Survey, 2P81, 2P82 (figured specimens).

Spathognathodus spiculus Youngquist and Miller

Plate 3, figures 18-21

Spathognathodus spiculus Youngquist and Miller, 1949, Jour. Paleontology, v. 23, no. 6, p. 622, pl. 101, fig. 4.

The Chester representatives of this species show a great amount of variation. Some are identical in all respects with the holotype from the Pella beds, but most show variation, particularly in the number and shape of the major anterior denticles. Future work may show that several Chester species are separable.

Distribution.—Renault, Paint Creek, Golconda, Glen Dean, Menard, Clore, and Kinkaid formations.

Repository.—Illinois State Geological Survey, 2P84-2P87 (figured specimens).

Spathognathodus sp. A

Plate 3, figure 25

Blade composed of twelve denticles strongly compressed laterally; denticles have short, blunt, free apices inclined somewhat irregularly posteriorly; anterior denticle larger and posterior three smaller than remainder. In lateral view crenulate oral margin slopes posteriorly, increasingly so near rear; anterior end convex; aboral margin is straight anterior to and posterior to very shallow navel. In aboral view navel has symmetrical, oblong-lanceolate outline; navel divided by medial groove that extends nearly to posterior and anterior tips of specimen; navel not quite half length of specimen with its ends equidistant from ends of specimen.

Because only a single specimen was found, a specific designation was not given.

Distribution.—Menard formation.

Repository.—Illinois State Geological Survey, 2P88 (figured specimen).

Spathognathodus sp. B

Plate 3, figure 22

Blade short, thick, bowed, composed of about ten denticles, one of which (located just anterior to middle and resulting from fusion of two germ denticles) is wider and longer than remainder; suppressed germ denticles evident; denticles sharply pointed, free in approximately upper half.

Aboral view.—Navel slightly asymmetric, outer lip with wider flare; navel doubly pointed with longer, narrower point reaching posterior tip of specimen; navel widest near anterior; groove extending from navel to anterior end of specimen; navel deepest near anterior end.

The single specimen represented does not justify specific designation.

Distribution.—Menard formation.

Repository.—Illinois State Geological Survey, 2P89 (figured specimen).

Genus Subbryantodus Branson and Mehl, 1933

Type species: *Subbryantodus arcuatus* Branson and Mehl

Branson and Mehl's original description (1933, p. 285):

Conspicuously arched denticulate bars with the anterior limb commonly the longer, and one or both limbs laterally flexed so as to produce a fairly regular concave inward curve of the unit as a whole; denticles confined to a single row on the oral edge, all somewhat laterally compressed and closely crowded or in contact, all inclined somewhat backward, one denticle of exceptional size, the apical denticle at the apex of the arch; germ denticles not conspicuously developed but when present corresponding to oral terminations; the aboral edge of the bar excavated beneath the arch apex by a long pit that tends to extend as a distinct groove along the edge of each limb.

Orientation.—The denticles are inclined posteriorly and the laterally concave side of the arch is the inner side. In most specimens the posterior limb is the shorter.

This genus is probably most closely related to *Bryantodus* Ulrich and Bassler. It differs most in that ordinarily there is no tendency toward lateral thickening of the oral edge of the bar and no development of apical lip on the aboral edge as in *Bryantodus,* and its trend is toward a split or grooved aboral edge through the development of the elongate pit rather than the sharp edge and limited pit of *Bryantodus. Subbryantodus* approaches some forms of *Ozarkodina* Branson and Mehl in the curvature of the bar and its blade-like proportions but lacks the germ denticle development and the suppression of germ denticles which is characteristic of *Ozarkodina.* Furthermore, all the ozarkodinids have thin sharp aboral edges. The closely crowded to fused, laterally compressed denticles and tendency toward split aboral edge serve to distinguish *Subbryantodus* from *Prioniodina* Ulrich and Bassler, in which the denticles are discrete and nearly circular in cross section.

Subbryantodus stipans Rexroad, n. sp.

Plate 4, figure 1

Arched and bowed blade-like unit; anterior limb composed of about ten denticles, generally three fewer on posterior limb; sharp-pointed denticles partially fused, laterally compressed, increasingly so posteriorly; denticles of anterior limb somewhat recurved and inclined posteriorly, those of posterior limb strongly inclined posteriorly; denticles tend to increase slightly in size posteriorly. Apical dentical about twice as wide as other denticles and much longer. Subapical pit greatly elongate, extending essentially the entire length of specimen; minute, conical, inner pit present below apical denticle.

Distribution.—Glen Dean and Menard formations.

Repository.—Illinois State Geological Survey, 2P90 (holotype).

Subbryantodus sp.

Plate 4, figure 2

Bar strongly and uniformly arched, bowed. Anterior limb deeper than posterior, each with six denticles, in contact, moderately compressed laterally; a small and a large denticle alternate regularly behind the small anterior-most denticle. Apical denticle about as wide as a pair (one large, one small) of other denticles, gently inclined posteriorly. Apical pit elongate, narrow with small, inner cone extending well up into bar, grooves continue pit to anterior and posterior ends of specimen.

The collection contained only one essentially complete specimen and one fragment that was doubtfully referred to this genus.

Distribution.—Glen Dean formation.

Repository.—Illinois State Geological Survey, 2P91 (figured specimen).

Genus Synprioniodina Bassler, 1925

Type species: *Synprioniodina alternata* Bassler

Bassler's original description (1925, p. 219) was:

Like *Palmatodella,* except that the down-turned front is much smaller, bar thick, denticles not turning forward so sharply, and the main cusp proportionately very large.

Huddle (1934, p. 53-54) adds:

Tooth consisting of cusp, denticulated bar and anticusp. The denticles on the anticusps are in the vertical plane of the bar and cusp. *Synprioniodina* differs from *Euprioniodina* in having the denticles closely appressed and joined by bar material; and the cusp is inclined upward rather than forward as in *Palmatodella.* The anticusp in *Palmatodella* is longer than the anticusp in *Synprioniodina.*

Synprioniodina sp.

Plate 4, figure 3

Posterior limb long, thin, somewhat arched, bowed inward, bearing appressed and laterally compressed denticles probably numbering about twelve. Apical denticle strongly compressed laterally, fore and aft edges sharp, inner face the more convex in cross section; probably straight in lateral view. Longitudinal axes of apical denticle and anterior limb nearly coincident; axes of the two limbs form angle of approximately forty degrees. Anterior limb bearing small, appressed, and laterally compressed denticles subparallel to apical denticle, but inclined more anteriorly. Minute pit at juncture of limbs, in outline has very slightly flared lateral lips; pit deep with sharp point extending into base of apical denticle.

Only a few fragmental specimens were found. The general form is similar to *Neoprioniodus camurus* and a relationship between the two is likely.

Distribution.—Renault formation.

Repository.—Illinois State Geological Survey, 2P92 (figured specimen).

Genus Trichonodella Branson and Mehl, 1948

Type species: *Trichognathus prima* Branson and Mehl

Branson and Mehl's original description (1933, p. 36):

Dental units consisting of an arched denticulate bar symmetrical in reference to the axis of an apical denticle. Apical denticle curved posteriorly, the base deeply excavated, the posterior aboral margin produced laterally into a horizontally extending more or less bar-like process.

The orientation of these dental units is assumed as transverse to the jaw for convenience of description.

Subsequently Hass (1953, p. 88-89) proposed the new genus *Roundya* for species formerly assigned to *Trichonodella* but which possess a denticulated posterior bar. In 1954 Lindström (1954, p. 599) indicated he, also, questioned the placing of forms with the denticulated posterior bar with *Trichonodella* but he hesitated to split the genus. I, too, at this time hesitate to accept the splitting of *Roundya* from *Trichonodella.*

Trichonodella fragilis Rexroad, n. sp.

Plate 4, figures 6 and 7

Posterior bar straight, long, slender, bearing widely spaced denticles or nodes; aboral surface broadly and shallowly excavated anteriorly, with medial groove extending posteriorly. Fang large, recurved, laterally compressed, elliptical near base and more rounded toward tip in cross section. Lateral bars shallow, bearing about three discrete, rounded denticles, the distal ones the larger; distal ends of bars spatulate, aboral edges sharp, but in some specimens faintly grooved medially; bars inclined about ten or fifteen degrees posteriorly; viewed from anterior, aboral margin of bars meet in obtuse angle at base of fang.

Distribution.—Renault, Paint Creek, Golconda, Glen Dean, Menard, and Kinkaid formations.

Repository.—Illinois State Geological Survey, 2P93 (holotype) and 2P94 (figured specimens).

Trichonodella imperfecta Rexroad, n. sp.

Plate 4, figures 4 and 5

Lateral bars in one plane, thin, blade-like, each with about eight to twelve appressed denticles that increase in length distally except for one or two much reduced at distal ends; denticles subround in cross section; aboral edges of lateral bars sharp, straight or slightly concave downward, the two meeting at approximately a right angle below apical denticle; anterior faces somewhat convex, posterior faces somewhat concave. Apical denticle gently recurved, triangular with rounded edges in cross section with base of isosceles triangle anterior and the longest face, posterior edge, tends to flatten toward base; base of apical denticle deeply excavated by a minute pit. There is a slight posterior expansion at the base of apical denticle, but it is not developed into a posterior bar.

Distribution.—Renault, Glen Dean, and Kinkaid formations.

Repository.—Illinois State Geological Survey, 2P95 (cotypes) and 2P96 (paratype variant).

Polygnathids

Plate 3, figures 10-12

Three fragments found in the Renault formation at two locations apparently are referable to *Polygnathus,* although in the two that show a pit, the pit is somewhat larger than would commonly be expected in the genus. Because each fragment differs from the other and because *Polygnathus* has not been recorded from this part of the column, each is figured and briefly described.

One fragment (fig. 12) is sharply arched with a well defined, nearly round pit immediately anterior to point of sharpest arch; aboral keel present. Oral outline nearly symmetrical, inner side slightly convex, outer somewhat more so. Carina nearly straight, distorted anteriorly. Nodes on margins of platform are the only ornamentation.

Another form (fig. 10) is strongly bowed with inner side concave, outer convex; platform ornamented with regular parallel transverse ridges, the posterior three or four merging with carina to form continuous transverse ridges across the specimen. Slightly arched; pit narrow, not sharply defined, keel present aborally.

The third specimen (fig. 11) is strongly bowed, asymmetric, the outer side the wider. Carina formed by completely fused denticles so its oral margin is smooth. Outer margins of plate nearly smooth, slightly lobate. Keel poorly developed.

Distribution.—Renault formation.

Repository.—Illinois State Geological Survey, 2P97, 2P98, 2P99 (figured specimens).

New Genus?

Plate 4, figures 8-13

More than two dozen fragmentary conodonts were found which vary considerably among themselves, but that are united in essential characteristics. Unfortunately the specimens are too fragmentary to provide an adequate picture of the individuals in the group. However, they apparently represent a single, undescribed genus. They seem to consist of three unequal, curving, denticulate limbs at whose union is an apical (?) denticle of moderate-to-small size that is subtriangular in cross section. At the base of the denticle (at the union of the limbs) is a deep pit, triangular in outline. One limb may be designated a posterior bar because of the recurvature, and in some cases slight compression, of the apical denticle. In relation to it one limb curves in an antero-lateral direction, the other in a postero-lateral direction. All three limbs may be arched. Differences among the specimens occur especially in the angular relations of the three limbs and the depth, curvature, and denticulation of the limbs.

Distribution.—Renault, Paint Creek, Golconda, Glen Dean, Menard, Clore, and Kinkaid formations.

Repository.—Illinois State Geological Survey, 2P100-2P105 (figured specimens).

Genus Indeterminate

Plate 4, figures 19-22

Lonchodina sp. Branson and Mehl, 1940, Denison Univ. Bull., Jour. Sci. Labs., v. XXXV, p. 171, pl. V, figs. 10, 12.
Lonchodina? spp., Youngquist and Miller, 1949, Jour. Paleontology, v. 23, no. 6, p. 620, pl. 101, figs. 7, (8?).

Many related specimens represented in the collection are too fragmentary for reference to a genus or for description because only one limb or process is complete. The other limb or bar is represented by only a fracture or very short portion because of its fragile nature and the large angle between the two limbs. I would interpret the poorly represented portion as a bar with a small main cusp, posterior to which is a series of denticles. Base of cusp has a deep pit. From the lateral face of the cusp arises an antero-lateral process, bowed convexly posteriorly, and bearing several stout discrete denticles, the whole larger than the main bar.

This interpretation does not fit known genera, although the specimens seem most closely related to *Ligonodina*. Differences among specimens occur in number of denticles of lateral process, in its length, depth, termination, and character of attachment scar; and in the denticulation and form of main bar.

Distribution.—Renault, Paint Creek, Golconda, Glen Dean, Menard, Clore, and Kinkaid formations.

Repository.—Illinois State Geological Survey, 2P106, 2P107, 2P108 (figured specimens).

Indeterminate Fragments

Plate 4, figures 14-18

Many denticulate fragments, either bar-like or blade-like, in the collection could belong to any of a number of genera such as *Neoprioniodus, Ligonodina, Hibbardella, Trichonodella, Hindeodella, Lonchodina, Cladognathus,* or *Prioniodina.* Although these specimens are too fragmentary to be classified, the more distinctive forms are figured.

Repository.—Illinois State Geological Survey, 2P112, 2P113, 2P114, 2P115, 2P116 (figured specimens).

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