CONODONTS FROM ISOLATED
DEVONIAN OUTCROPS

by

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DEVONIAN OUTCROPS

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ABSTRACT

Shales, sandy shales, and sandstones were sampled from isolated outcrops at Sulphur Springs and at Coal Hollow in Ste. Genevieve County. An attempt was made to find the answers to the following questions: (1) Can the boundary between the Devonian and the Mississippian be located at these localities by determining the distribution of conodonts? (2) Are there faunal differences between the conodonts in the Devonian part of the section? (3) Are there differences between the conodonts of the sandstones and the sandy shales that may be interpreted as environmental responses? (4) What other formation or formations do the conodonts of these two Devonian sections or parts of these sections suggest as time equivalents? It was concluded the the boundary can be located in each of these localities. It was also concluded that there are no faunal differences in the Devonian part of the Ste. Genevieve County section or between the sandstones and shales that could not be interpreted as the result of factors which could not be controlled in the present study. Other formations or sections suggested as time equivalents to the Ste. Genevieve County section are the sandstone facies of the Eureka shale, the Sees Creek section, and the "Grassy Creek" group, as defined in this paper. Owing to the lack of conodonts in the Sulphur Springs samples, no similar conclusions were drawn concerning this locality.

INTRODUCTION

In many places in Missouri the strata which lie between those generally agreed upon as Devonian and those generally agreed upon as Mississippian consist of black shales, shaly sandstones, sandy shales, and sandstones. To these "boundary units," varying in thickness from a few inches to a few feet, the names Sylamore and Bushberg have been more or less indiscriminately applied, although there has been no general agreement on the age or identity of either of these two formations. Each has been designated as Devonian and as Mississippian in age and each has been considered as transitional by some workers. This has led many stratigraphers to conclude that the Devonian grades into the Mississippian in areas where one of these units occurs.

M. G. Mehl, in an unpublished report for the Missouri Geological Survey, has summarized the history of the terms Sylamore and Bushberg, and has made recommendations regarding their use. Among these is the recommendation that the term Sylamore be dropped, and that any conodont fauna from a sandstone in the Devonian black shale of Arkansas or southwestern Missouri be described as that of the sandstone facies of the Eureka shale. Another recommendation is that the term Bushberg be used only for certain Devonian rocks in the vicinity of Bushberg, Missouri, because there is at present no way to determine

the exact age of the sandstone at the type locality inasmuch as its relations there are not closely limiting.

In connection with Dr. Mehl's study of these boundary formations he found a challenging section at Sulphur Springs in Jefferson County, Missouri, and another at Coal Hollow in Ste. Genevieve County, Missouri. These two sections, both isolated from other similar sections and separated from each other by a distance of between forty and fifty miles, differ markedly in their details. They have in common hard blocky or fissile black shale, sandstone, and a limited thickness of greenish yellow sandy clay. In each case there are sharp limiting boundaries, the base of the Fern Glen (Mississippian) at the top and the Ordovician Kimmswick at the bottom.

My attention was called to these sections in connection with special studies of conodonts, and in the fall of 1956 I made detailed sections at the two localities (see figs. 1 and 2) and did extensive zonal collecting at each place. Diligent search failed to produce megafossils in the critical parts of the sections, but casual examination suggested the possibility of a fair abundance of conodonts. It was with this possibility in mind that the lithologic samples were collected.

It was hoped that the study of these sections would add to the existing knowledge of the use of conodonts in stratigraphic determinations and provide answers for the

following questions:

1. - Can the boundary between the Devonian and the Mississippian in these sections be located by determining the distribution of the conodonts?
2. - Are there faunal differences between the conodonts in the Devonian part of the section?
3. - Are there differences between conodonts of the sandstones and those of the black shales that may be interpreted as environmental responses?
4. - What other formation or formations do the conodonts of these two Devonian sections or parts of these sections suggest as time equivalents?

METHODS OF WORK

Selection of Faunas for Comparative Studies.---In the early stages of my investigation it was decided that the details of a considerable number of described Devonian conodont faunas would be studied. Several of these studies are based on collections in the University of Missouri Collection, and all such conodont material was made available to me for intensive restudy. Other faunas were available to me only as published lists, descriptions, and illustrations.

Faunas extensively studied with respect to the time equivalents of these Devonian sections, or parts of these sections, to other formations may be listed as

follows: (1) the fauna of the Eureka sand-shale complex, described in an unpublished master's thesis by Quigley in 1942, and in another by Woods in 1955; (2) that of the Hardin sandstone of Tennessee (beneath the Chattanooga black shale), described in an unpublished master's thesis by Ryan in 1943; (3) and the fauna of the "Grassy Creek" formation, as described by Branson and Mehl in 1933.

Actually, the study of Grassy Creek conodonts resolved itself into the analysis of six different groups or faunas with the possibility that none of them is Grassy Creek in age and the likelihood that not more than one is Grassy Creek, as indicated in the following paragraphs.

In view of later work, it is apparent that at several places listed by Branson and Mehl as Grassy Creek localities the typical Grassy Creek lithology is not to be found, and in some places the strata are now considered to be of a different age.

The locality at Providence is a channel fill which is late Devonian but lithologically unlike the typical Grassy Creek. The fauna from Providence should be compared with that of the typical Grassy Creek, but it remains to be determined if the two are time equivalents.

The fauna of the locality at Dixie is now recognized as representing the development found in the strata now called the Holt Summit formation.

The shale which occurs at Noel is known to be equivalent to the Eureka shale, and its fauna should therefore be compared with, rather than accepted as, Grassy Creek. The samples taken from the locality on James River should also be listed as the Eureka fauna.

The locality listed in Ste. Genevieve County was known to be late Devonian at the time of Branson and Mehl's study, and the term Grassy Creek was at that time a general designation for all late Devonian strata of Missouri. At the present time a wide variety of late Devonian strata is known, and it is increasingly evident that there is a considerable variety in the conodont faunas from the several groups of strata. It is also obvious that the fauna from Ste. Genevieve County should be compared with that of the typical Grassy Creek and other units, rather than listed with the Grassy Creek. The fauna from the locality at Sulphur Springs should also be compared with that of the typical Grassy Creek, for the same reason.

There is some question as to whether the fauna from the locality at Sees Creek should be listed with that of the Grassy Creek. The samples from which the fauna was obtained came from an unctuous clay immediately above the Callaway limestone and below rather than in the typical Grassy Creek. For the present purpose I have decided that the Sees Creek fauna should be listed

separately.

In the remaining localities listed by Branson and Mehl, all north of the Lincoln Fold (Cap au Gres fault), there is a possibility that the conodonts found represent the Grassy Creek development, but even there this may be questioned. At the time of their listing there was no distinction made between the Grassy Creek and the overlying Saverton. Dr. Mehl has indicated to me that the conodonts listed from Louisiana, Monroe City, and possibly Grassy Creek very likely come from the Saverton rather than the Grassy Creek.

In the light of the foregoing, I have found it most promising to list the late Devonian faunas actually identified by me under the headings Eureka, Hardin, Sees Creek, Dixie or Holt's Summit, and Saverton. Too little is known concerning the "Providence" fauna to be of use here. I have compared the faunal lists which I determined from Sulphur Springs and from Coal Hollow with these. All of these faunas were studied by reference to the actual materials housed in the conodont collections of the University of Missouri. It was felt that the comparison of the fauna from Ste. Genevieve County or that from Sulphur Springs with other faunal lists would be of limited value if the several lists were prepared by several different investigators. At present the study of speciation in connection with the conodonts has

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received little attention and faunal lists give evidence of marked "individuality." There are instances recorded where two faunal lists by two different authors, studies of collections from the same stratigraphic unit at a single locality, are so markedly different that they leave in doubt all but the broadest aspects of faunal relations. As an example of this "individuality," the papers by Thomas (1949) and by Youngquist and Patterson (1949) on the fauna of the lower Mississippian Prospect Hill formation may be cited. Although lists made by a single investigator may include many errors of observation, all such errors color all parts of the faunal picture to the same extent. It follows that the comparison of faunal lists set up by one observer should give a more nearly correct picture of the distribution of genera and species in the faunas to be compared than would a compilation from the lists of several authors.

In addition to the lists prepared in keeping with the above procedure, other faunas were studied from the literature for background material. These included faunas from the Sweetland Creek formation in Iowa, the Olentangy shale of Ohio, the New Albany shale of Indiana, the Chattanooga shale of Tennessee, the Huron of Ohio, the lower Ohio shale of Ohio, and the Bushberg of Missouri as described by Branson and Mehl.

Field Work.--Samples were collected on a field trip taken under the leadership of Dr. M. G. Mehl in October 1956. The samples were numbered in accordance with the numbering system used by Dr. Mehl in his work with the Missouri Geological Survey, using MGS-M in front of the number itself, to indicate Missouri Geological Survey-Mehl. The samples taken in Ste. Genevieve County were numbered MGS-M 540 to MGS-M 549. The samples taken at Sulphur Springs were numbered MGS-M 550 to MGS-M 552.

Laboratory Procedure.--The volume of the samples was reduced in the following manner: If the sample was of sandstone it was crushed, then alternately boiled and flushed gently with water. Commonly these samples were "acidized" in a 10% solution of glacial acetic acid. Crushing the sandstone reduces the proportion of complete specimens recovered. However, possible errors in identification from fragmental material are not believed to be an important factor. If the sample was of shale or sandy shale, it was alternately boiled and flushed gently with water. "Acidizing" was omitted for these samples. When the samples were free of clay particles, leaving the quartz, heavy minerals, and conodonts, they were dried. The material was then passed through 20-, 40-, 60-, and 80-mesh screens. Most of the specimens remained on the 40- and 60-mesh screens, although fragments were found on the smaller screen. Some of the material was further

segregated by the use of a heavy liquid of such a density that the quartz floated and the conodonts and heavy minerals sank to the bottom and were drawn off. The conodonts were separated from the heavy minerals under the binocular microscope by the use of a camel's hair brush. They were then mounted in single hole cardboard slides for photography and study.

HISTORY AND STRATIGRAPHIC RELATIONSHIPS OF NAMES AND STRATA INVOLVED

Very little has been written covering the details of the localities sampled and reported on in this study, but the formations with which these are compared have received a considerable amount of attention.

The Bushberg was named by Ulrich (1904) as a member of the Sulphur Springs formation. It is not recognizable at Sulphur Springs, but a thick sandstone that answers the description of the Bushberg occurs along the Mississippi River near there. In their study of the conodonts coming from the Bushberg, Branson and Mehl (1933) sampled from strata at Frenchman Creek, Brickeys, and Coal Hollow in Ste. Genevieve County; Lanagan in MacDonald County; and Williamsburg in Callaway County, and used materials from all these localities for their described and figured specimens. They described the fauna as of basal Mississippian age, and subsequent studies indicate that the age was correctly determined but that the fossils did not come from the Bushberg. In his report for the Missouri Geological Survey, M. G. Mehl indicates that a thin sand immediately below the Fern Glen in the area studied by Ulrich should be referred to the Readsville formation, a new formation described in Mehl's report. An Osage conodont fauna is found in this sandstone. The relatively thick sandstone occurring in this vicinity, beneath the

thin sand here described, having conodonts of Devonian age and no indication of Mississippian age, should be called Bushberg, according to Dr. Mehl. He recommends restriction of this term to rocks in the Bushberg-Glen Park area because the Devonian conodonts are broken and may not be indigenous and there are at present no other ready means of identification of the strata.

The first published use of the term Sylamore was by Penrose (1891) for exposures on Sylamore Creek in Stone County, Arkansas. He described it as a sandstone containing black or green shale, grading into the shale in some places. Hopkins (1893), in his work on the Batesville area of Arkansas, implies that the Sylamore and the associated black shale (Eureka) are Mississippian, and suggests that the Sylamore is underlain by the Eureka. Ulrich (1904) stated that the Eureka shale underlies the St. Joe limestone, overlies the Sylamore, and is equal to the Noel shale of Missouri. Purdue and Miser (1916) stated that the Eureka underlies the St. Joe limestone member of the Boone limestone and is divided into the black shale member and the underlying Sylamore member.

The age of these formations has long been in question, perhaps due to the uncertainty of their stratigraphic relationships. H. S. Williams (1900) considered the Sylamore to be transitional between the Devonian and the Mississippian. He also referred the top of the Eureka

shale to the Mississippian, stating that it correlated with the Louisiana limestone of Missouri. Gallaher (1898) considered the Louisiana to be Devonian. Ulrich (1904) considered the Sylamore to be Devonian. Adams and Ulrich (1904) believed that the Eureka shale of Arkansas was the same as the shale which is called Noel in Missouri, and considered it to be Kinderhook (Mississippian) in age. In 1905 they mentioned the Devonian as consisting of a single formation, the Chattanooga, of which the Sylamore is the basal member, in that area.

Croneis (1930) recognized the sandstone below the Chattanooga as a formation, not a member of the Chattanooga. He considered the sandstone to be Mississippian. Branson (1944) placed the Louisiana in the Devonian on the basis of conodonts. Following H. S. Williams (1900), this would place the Eureka in the Devonian. J. S. Williams (1943) considered the Louisiana to be Mississippian.

Shumard (1873) and Weller and St. Clair (1928) mentioned a sandstone of doubtful age in Ste. Genevieve County. Shumard (1873) also mentioned the sandstone which occurs at Sulphur Springs. He described a few feet of brown sandstone from this locality, and placed it in the Devonian.

Among the black shales found in Missouri is the Grassy Creek, which occurs in northeastern Missouri.

It was named by Keyes (1897) for exposures on Grassy Creek, near Louisiana, Missouri. He included black and green shales which underlie the Louisiana in this locality. Rowley (1907) referred to the Grassy Creek at Louisiana and on Grassy Creek. In 1913 Keyes proposed the name Saverton for the upper blue (green) member of the Grassy Creek. He stated that this unit thickens northward and merges with the Hannibal shales. Branson (1918, 1923) did not agree with this division of the Grassy Creek, nor did Krey (1924). Moore (1928) followed Keyes in differentiating the Saverton and the Grassy Creek. Branson and Mehl (1933) did not separate the beds in their description of the Grassy Creek conodonts. Udden (1899) regarded the Grassy Creek to be the same age as the Sweetland Creek beds in Iowa, and regarded them as Devonian. The name Sweetland Creek was used for a time for beds in Iowa and Missouri.

PREVIOUS WORK

No study of the conodonts from the two localities herein described has been published. However, studies of conodonts from other localities in the state have a direct bearing on the faunas from Sulphur Springs and Coal Hollow as described in the following paragraphs:

The conodonts of the Eureka sand-shale complex of southwestern Missouri and northwestern Arkansas have received some attention in fairly recent years. They are described in works which list the strata as Sylamore. In 1935 McKnight listed seven genera of conodonts from exposures in the Yellville quadrangle of northern Arkansas. Branson and Mehl (1938) mentioned them in their report on the conodont genus Ieriodus and its stratigraphic distribution. Clark (1941) mentions conodonts from the Sylamore in his work on the Cassville quadrangle of Missouri. Quigley (1942) described the fauna of the Sylamore from localities in Barry, Benton, and MacDonald Counties in Missouri. Woods (1955) described the fauna of the Sylamore in parts of southwestern Missouri and northwestern Arkansas.

The conodonts of the Bushberg were described by Branson and Mehl (1933). In their samples they obtained a fauna of Mississippian age, but this should not be considered the fauna of what is now to be called Bushberg.

As indicated in the previous paragraphs, I have distributed the conodonts from the Grassy Creek as listed by Branson and Mehl under the headings Holt Summit, Sees Creek, and "Grassy Creek" or Saverton. Too little is known of the fauna from Providence to warrant its inclusion here. The fauna from the locality at Noel is also included separately. In addition to the contributions to the faunas of these units by Branson and Mehl there has been made available to me a faunal list along with the conodonts on which it was erected by Roy O. Taylor for the Sees Creek section. This list was done for a term paper for the course in micropaleontology in the fall of 1956 at the University of Missouri.

I have also examined the conodonts and the lists of the Holt Summit fauna prepared by Donald Zalusky for his thesis recently presented in partial fulfillment of the requirements for the degree of Master of Arts.

DISTRIBUTION OF CONODONTS IN THE SECTIONS STUDIED

In figures 1 and 2 are shown the essential details of the stratigraphic succession at Sulphur Springs and Coal Hollow. As indicated, the numbers at the left of the column show the position of the samples which are recorded according to the numerical system used by Dr. Mehl in his work with the Missouri Geological Survey.

Sulphur Springs Locality.--The samples taken at Sulphur Springs produced very few conodonts. The samples taken from the shales were not productive. The samples taken from the sandstone produced conodonts which indicated the age of the sandstone to be Mississippian, and therefore out of the scope of the present study. No species were listed by Branson and Mehl from Sulphur Springs in the report on the Grassy Creek conodonts. No identifiable species were found in the black shale in the present study. This section needs further study in order to determine whether it should be correlated with the Grassy Creek.

Ste. Genevieve County Locality.--The conodonts selected from the Ste. Genevieve County locality for description and photography are distributed in four families and thirteen genera, all previously described.

Twenty-five previously described species are recognized. Of these, eighteen were first described by

Branson and Mehl from what they called the Grassy Creek. The others were first described from other Devonian formations.

Four new species are described. Fifteen specimens are listed whose specific affinities could not be determined.

Table 1 shows that in reference to number of species the samples producing conodonts in the greatest abundance were MGS-M 542, MGS-M 544, and MGS-M 548. The sample numbered MGS-M 546 was not productive.

The fauna in the section at Coal Hollow is broken down into six units, counting samples 543 and 544 as one unit (both having come from the same sandy shale, 543 at its bottom, 544 at its top) and counting 541 as the same unit as 542. Sample 541 was taken from blocks in the creek bed below the outcrop of the other units. It is the same lithologically, and, as far as I could determine, has the same fauna as sample 542. Table 1 shows the distribution of conodonts in the samples taken at this locality. Figure 1 shows the lithologies involved in the samples. Samples 541-542, 545, 548, and 549 are from sandstones. Samples 543, 544, and 547 are from sandy shales. Sample 546 is from a hard black fissile shale. The fauna of the sandstones, except that of sample 549 is alike except that samples 542 and 548 yielded many more species of conodonts than the other two. Differences

in the species found in each may well be the result of differences in sampling, abundance of conodonts in the layers, or some other factor which could not be controlled in this study. I do not consider these differences to be the result of basic differences in fauna. The fauna of the sandy shale samples is likewise similar, except that sample 544 was more productive than the others. I do not consider the differences which exist between the conodonts found in these samples to be the result of basic differences in fauna. They may result from inadequacies in sampling, differences in abundance of conodonts in the samples, or differences in treatment in the laboratory. Taking the sandstones as one unit, and the sandy shales as one unit, it is possible to make a list of species from each of these, and to compare lists. The following are lists made up according to lithologies:

Sandstones

Hindeodella sp.
 Ligonodina acuta Branson and Mehl
 Prioniodus confluens Branson and Mehl
 Prioniodus obtusus Branson and Mehl
 Prioniodus sp.
 Trichonodella sp.
 Bryantodus confragus Branson and Mehl
 Bryantodus crassidens Branson and Mehl
 Bryantodus sp.
 Nothognathella abbreviata Branson and Mehl
 Nothognathella (?) abnormis Branson and Mehl
 Nothognathella angusta Stauffer
 Nothognathella reversa Branson and Mehl
 Nothognathella sp. A
 Nothognathella sp.

Ozarkodina sp. A
 Ozarkodina sp. B
 Prioniodina aberrans n. sp.
 Prioniodina curvata Branson & Mehl
 Prioniodina sp. indet. B
 Prioniodina sp. indet. C
 Spathognathodus sp.
 Ancyrognathus irregularis Branson and Mehl
 Ancyrognathus symmetrica Branson and Mehl
 Ancyrognathus sp.
 Palmatolepis delicatula Branson and Mehl
 Palmatolepis distorta Branson and Mehl
 Palmatolepis glabra Ulrich and Bassler
 Palmatolepis minuta Branson and Mehl
 Palmatolepis perlobata Ulrich and Bassler
 Palmatolepis quadrantinodosa Branson
 and Mehl
 Palmatolepis subperlobata Branson and Mehl
 Polygnathus aperta, n. sp.
 Polygnathus foliata Bryant
 Polygnathus munita n. sp.
 Polygnathus nodocostata Branson and Mehl
 Polygnathus siphonata n. sp.
 Polygnathus varinodosa Branson and Mehl
 Polygnathus sp.
 Icriodus alternatus Branson and Mehl
 Icriodus symmetricus Branson and Mehl
 Icriodus sp. A

Sandy shales

Prioniodus confluens Branson and Mehl
 Trichonodella sp.
 Bryantodus crassidens Branson and Mehl
 Nothognathella angusta Stauffer
 Prioniodina sp. indet. A
 Ancyrognathus bifurcata (Ulrich and Bassler)
 Ancyrognathus irregularis Branson and Mehl
 Ancyrognathus symmetrica Branson and Mehl
 Palmatolepis glabra Ulrich and Bassler
 Palmatolepis minuta Branson and Mehl
 Palmatolepis perlobata Ulrich and Bassler
 Palmatolepis subperlobata Branson and Mehl
 Polygnathus aperta n. sp.
 Polygnathus siphonata n. sp.
 Polygnathus varinodosa Branson and Mehl
 Icriodus alternatus Branson and Mehl
 Icriodus sp. A

I consider the differences in species noted above to be the result of inadequacies of sampling, differences in abundance of conodonts in the beds involved, or differences in the method of treatment in the laboratory. It is impossible to treat the sandy shales in the same manner as the sandstones to obtain the conodonts from them, and this may in part account for the lack of species in the sandy shales. The hard black fissile shale sampled and numbered 546, which produced no conodonts, seems to grade into the sandy shale sampled and numbered 547, so it may be regarded as being the same as 547. In view of the foregoing conclusions, it may be concluded that the beds sampled at the Coal Hollow locality may be regarded as one unit, and that there is no basis for separating the beds involved into different formations.

The sample numbered 549 produced a different group of conodonts than the other samples. A list of species from this sample is given below:

Prioniodus barbatus
Ozarkodina regularis
Pseudopolygnathus prima
Pseudopolygnathus varicostata
Solenodella costata
Synprioniodina delicatula
Palmatolepis distorta
Polygnathus distorta
Polygnathus communis
Polygnathus inornata
Siphonodella duplicata
Icriodus symmetricus

"Grassy Creek" Group.--The localities which remain after those listed by Branson and Mehl at Sees Creek, Sulphur Springs, Ste. Genevieve County, Dixie, Providence, James River, and Noel are omitted because they do not represent the typical Grassy Creek, as stated previously, yield a fauna which might be called that of the "Grassy Creek" group. This may not be the fauna of the Grassy Creek. The conodonts from the localities at Louisiana, Clarksville, Monroe City, South River, and Grassy Creek may be from the overlying Saverton, rather than the Grassy Creek. In view of these possibilities, the following list of genera and species from the "Grassy Creek" group is the best that can be made in the light of present knowledge.

Spathognathodus inornatus (Branson and Mehl)
 Spathognathodus fissilis (Branson and Mehl)
 Spathognathodus aculeatus (Branson and Mehl)
 Spathognathodus stabilis (Branson and Mehl)
 Spathognathodus disparilis (Branson and Mehl)
 Spathognathodus cf. arcuatus (Branson and Mehl)
 Ozarkodina macra Branson and Mehl
 Hindeodella notha Branson and Mehl
 Hindeodella acuta Branson and Mehl
 Hindeodella minuta Branson and Mehl
 Ligonodina robusta Branson and Mehl
 Trichonodella tumida (Branson and Mehl)
 Trichonodella laminata (Branson and Mehl)
 Prioniodus obtusus Branson and Mehl
 Prioniodus confluens Branson and Mehl
 Euprioniodina munda Branson and Mehl
 Icriodus alternatus Branson and Mehl
 Icriodus symmetricus Branson and Mehl
 Nothognathella incurva Branson and Mehl
 Nothognathella abbreviata Branson and Mehl
 Nothognathella reversa Branson and Mehl
 Palmatolepis glabra Ulrich and Bassler

Palmatolepis perlobata Ulrich and Bassler
Palmatolepis subperlobata Branson and Mehl
Palmatolepis quadrantinodosa Branson and Mehl
Palmatolepis rugosa Branson and Mehl
Palmatolepis minuta Branson and Mehl
Ancyrodella minutanodosa Branson and Mehl
Ancyrognathus irregularis Branson and Mehl
Polylophodonta gyratlineata (Holmes)
Polylophodonta concentrica (Ulrich and Bassler)
Polygnathus rhomboidea Ulrich and Bassler
Polygnathus triangularis Branson and Mehl
Polygnathus semicostata Branson and Mehl
Polygnathus subserrata Branson and Mehl
Polygnathus varinodosa Branson and Mehl

The above list is made up from the lists of Branson and Mehl plus my observations of the slides collected by Branson and Mehl in their work on the Grassy Creek.

Sees Creek.--The species obtained by Branson and Mehl from the locality on Sees Creek are listed here separately. They may or may not represent the Grassy Creek. They were obtained from an unctuous clay immediately above the Callaway, and not from typical Grassy Creek lithology.

Spathognathodus acutus (Branson and Mehl)
Spathognathodus nodosus (Branson and Mehl)
Ozarkodina macra Branson and Mehl
Ozarkodina multidentata Branson and Mehl
Ozarkodina abnormis Branson and Mehl
Hindeodella brevis Branson and Mehl
Hindeodella notha Branson and Mehl
Centrognathodus sinuosa (Branson and Mehl)
Centrognathodus delicata (Branson and Mehl)
Centrognathodus spuria (Branson and Mehl)
Ligonodina delicata Branson and Mehl
Ligonodina flexuosa Branson and Mehl
Ligonodina acuta Branson and Mehl
Ligonodina recurvata Branson and Mehl
Trichonodella laminata (Branson and Mehl)

Diplodella alternata Branson and Mehl
Prioniodus obtusus Branson and Mehl
Prioniodus confluens Branson and Mehl
Prioniodus semiseparatus Branson and Mehl
Prioniodus mutabilis Branson and Mehl
Prioniodus tortus Branson and Mehl
Euprioniodina confluens Branson and Mehl
Lonchodina profunda Branson and Mehl
Lonchodina (?) robusta Branson and Mehl
Prioniodina peculiaris Branson and Mehl
Prioniodina symmetrica Branson and Mehl
Prioniodella (?) torta Branson and Mehl
Bryantodus macilentus Branson and Mehl
Bryantodus confragus Branson and Mehl
Bryantodus inequalis Branson and Mehl
Bryantodus confluens Branson and Mehl
Bryantodus simplex Branson and Mehl
Bryantodus equalaterus Branson and Mehl
Bryantodus (?) dubius Branson and Mehl
Polygnathellus nothus Branson and Mehl
Icriodus symmetricus Branson and Mehl
Nothognathella typicalis Branson and Mehl
Nothognathella incurva Branson and Mehl
Nothognathella polygnathoidea Branson and Mehl
Nothognathella abbreviata Branson and Mehl
Nothognathella condita Branson and Mehl
Nothognathella irregularis Branson and Mehl
Nothognathella reversa Branson and Mehl
Nothognathella (?) abnormis Branson and Mehl
Nothognathella solida Branson and Mehl
Palmatolepis glabra Ulrich and Bassler
Palmatolepis perlobata Ulrich and Bassler
Palmatolepis subperlobata Branson and Mehl
Palmatolepis delicatula Branson and Mehl
Ancyrognathus irregularis Branson and Mehl

Dixie.--The species obtained from this locality come from strata now known to represent the formation called the Holt Summit. They are listed here separately from the Holt Summit species, as those obtained by Branson and Mehl are slightly different from those obtained from Holt Summit localities by Donald Zalusky for his thesis recently submitted in partial fulfillment of the requirements for the degree of Master of Arts.

Dixie species:

Spathognathodus rectus (Branson and Mehl)
 Spathognathodus strigosus (Branson and Mehl)
 Spathognathodus arcuatus (Branson and Mehl)
 Spathognathodus robustus (Branson and Mehl)
 Spathognathodus disparilis (Branson and Mehl)
 Spathognathodus amplus (Branson and Mehl)
 Spathognathodus jugosus (Branson and Mehl)
 Spathognathodus (?) ornatus (Branson and Mehl)
 Ozarkodina arcuata Branson and Mehl
 Hindeodella acuta Branson and Mehl
 Apatognathus varians Branson and Mehl
 Trichonodella tumida Branson and Mehl
 Prioniodus molestus Branson and Mehl
 Euprioniodina gracilis Branson and Mehl
 Euprioniodina munda Branson and Mehl
 Lonchodina separata Branson and Mehl
 Lonchodina pulchra Branson and Mehl
 Lonchodina brevipennata Branson and Mehl
 Lonchodina latericrescens Branson and Mehl
 Prioniodina compressa Branson and Mehl
 Prioniodina curvata Branson and Mehl
 Prioniodina (?) abnormis Branson and Mehl
 Bryantodus crassidens (?) Ulrich and Bassler
 Bryantodus attenuatus Branson and Mehl
 Bryantodus delicatus Branson and Mehl
 Bryantodus brevidens Branson and Mehl
 Bryantodus breviposteus Branson and Mehl
 Bryantodus arcuatus Branson and Mehl
 Bryantodus commutatus Branson and Mehl
 Palmatolepis glabra Ulrich and Bassler
 Palmatolepis perlobata Ulrich and Bassler
 Palmatolepis subperlobata Branson and Mehl
 Palmatolepis rugosa Branson and Mehl
 Palmatolepis minuta Branson and Mehl
 Palmatolepis distorta Branson and Mehl
 Palmatolepis gracilis Branson and Mehl
 Ancyrodella rugosa Branson and Mehl
 Ancyrodella minutanodosa Branson and Mehl
 Ancyrodella lobata Branson and Mehl
 Ancyrognathus curvata Branson and Mehl
 Ancyrognathus quadrata Branson and Mehl
 Ancyrognathus irregularis Branson and Mehl
 Polylophodonta gyratilineata (Holmes)
 Polygnathus angusta Branson and Mehl
 Polygnathus brevilamina Branson and Mehl
 Polygnathus nodocostata Branson and Mehl
 Polygnathus triangularis Branson and Mehl
 Polygnathus semicostata Branson and Mehl

Polygnathus sinelamina Branson and Mehl
Polygnathus suberrata Branson and Mehl
Polygnathus varinodosa Branson and Mehl

Holt Summit.--The Holt Summit formation has been studied by Donald Zalusky, and he has listed its fauna in a thesis presented to the graduate school of the University of Missouri in partial fulfillment of the requirements for the degree of Master of Arts. The fauna which he has listed includes previously described species and new species. The following is a list of the previously described species from the Holt Summit:

Ancyrodella lobata Branson and Mehl
Ancyrodella nodosa Ulrich and Bassler
Ancyrodella robusta Stauffer
Ancyrognathus irregularis Branson and Mehl
Ancyrognathus symmetrica Branson and Mehl
Angulodus demissus Huddle
Bryantodus commutatus Branson and Mehl
Bryantodus dignatus Stauffer
Bryantodus mundus Branson and Mehl
Bryantodus nitidus Ulrich and Bassler
Bryantodus winchelli Stauffer
Diplodella alternata Branson and Mehl
Hibbardella plara Thomas
Hindeodella brevis Branson and Mehl
Hindeodella subtilis Ulrich and Bassler
Icriodus alternatus Branson and Mehl
Icriodus curvatus Branson and Mehl
Icriodus symmetricus Branson and Mehl
Ligonodina delicata Branson and Mehl
Lonchodina brevipennata Branson and Mehl
Lonchodina curvidens E. R. Branson
Lonchodina pulchra Branson and Mehl
Lonchodina (?) *robusta* Branson and Mehl
Nothognathella condita Branson and Mehl
Nothognathella reversa Branson and Mehl
Nothognathella typicalis Branson and Mehl
Ozarkodina arcuata Branson and Mehl
Palmatolepis distorta Branson and Mehl
Palmatolepis flabelliformis Stauffer
Palmatolepis glabra Ulrich and Bassler

Palmatolepis gracilis Branson and Mehl
Palmatolepis minuta Branson and Mehl
Palmatolepis perlobata Ulrich and Bassler
Palmatolepis quadrantinodosa Branson and Mehl
Palmatolepis rugosa Branson and Mehl
Palmatolepis subperlobata Branson and Mehl
Polygnathus angustidiscus Youngquist
Polygnathus brevilamina Branson and Mehl
Polygnathus caelatus Bryant
Polygnathus communis Branson and Mehl
Polygnathus granulosa Branson and Mehl
Polygnathus nodocostata Branson and Mehl
Polygnathus cf. *rhomboidea* Branson and Mehl
Polygnathus sanduskiensis Stauffer
Polygnathus semicostata Branson and Mehl
Polygnathus sinelamina Branson and Mehl
Polygnathus subserrata Branson and Mehl
Polygnathus triangularis Branson and Mehl
Polygnathus varinodosa Branson and Mehl
Polylophodonta concentrica Branson and Mehl
Polylophodonta gyratilineata Branson and Mehl
Polylophodonta linguiformis Branson and Mehl
Polylophodonta rugosa Branson and Mehl
Prioniodus molestus Branson and Mehl
Prioniodus obtusus Branson and Mehl
Prioniodus tortus Branson and Mehl
Spathognathodus acutus (Branson and Mehl)
Spathognathodus amplus (Branson and Mehl)
Spathognathodus regularis (Branson and Mehl)
Spathognathodus strigosus (Branson and Mehl)
Trichonodella robusta (Branson and Mehl)
Trichonodella tumida (Branson and Mehl)

In addition to the above genera and species, Zalusky has listed one new species of Ancyrodella, one new species of Angulodus, one new species of Icriodus, one new species of Nothognathella, two new species of Palmatolepis, two new species of Ozarkodina, nine new species of Polygnathus, one new species of Polylophodonta, two new species of Prioniodus, two new species of Spathognathodus, and two new species of Trichonodella.

Noel.--The black shale which occurs at Noel is now known to be the same as the shale which has been called Eureka. The list of genera and species found by Branson and Mehl in the samples taken at Noel should be compared to the fauna of the typical Grassy Creek. A list of genera and species from the Noel locality for such a comparison follows:

Palmatolepis glabra Ulrich and Bassler
Palmatolepis perlobata Ulrich and Bassler
Polylophodonta gyratilineata (Holmes)
Polylophodonta concentrica (Ulrich and Bassler)
Polylophodonta rugosa Branson and Mehl
Polylophodonta linguiformis Branson and Mehl
Polygnathus rhomboidea Ulrich and Bassler
Polygnathus angusta Branson and Mehl
Polygnathus brevilamina Branson and Mehl
Polygnathus granulosa Branson and Mehl
Polygnathus nodocostata Branson and Mehl
Polygnathus triangularis Branson and Mehl
Polygnathus semicostata Branson and Mehl

Providence.--No species from the late Devonian channel fill at Providence were listed by Branson and Mehl in their study of the Grassy Creek conodonts. This section needs further study in order to determine whether it correlates with the typical Grassy Creek.

From the foregoing lists of species, it seems that the sections which are most closely related are those at Dixie and Holt Summit. Also showing a relation in the number of species in common are the Grassy Creek group and the Holt Summit, the Sees Creek section and the Holt Summit, and the "Grassy Creek" group and the Sees Creek

section. Some of the species shared by the "Grassy Creek" group and other sections may be the result of the "Grassy Creek" group not being entirely the typical Grassy Creek, but partly Saverton. There is also a close relation between the Coal Hollow section and the Sees Creek section, and between the Coal Hollow section and the "Grassy Creek" group. Seemingly unrelated as judged by the number of shared species are the sections at Noel and Dixie, Sees Creek and Dixie, Noel and Sees Creek, and Noel and the "Grassy Creek" group. These judgements may also be colored by the lack of a unified fauna in the Grassy Creek group.

Table 1 shows the distribution of genera and species in the samples from Coal Hollow. Table 2 shows the distribution of Coal Hollow species in other units, using a list from the "Grassy Creek" group, omitting species from those localities not now considered to be typical Grassy Creek. The species listed are from the localities at Louisiana, on Grassy Creek, at Monroe City, on South River, and at Clarksville.

AGE OF SECTIONS STUDIED

Sulphur Springs.--The age of this section cannot be fully determined at the present time. The shale at Sulphur Springs did not yield conodonts for which the age could be fixed. The sandstone above the shale (see fig. 2) yielded conodonts which indicated its age to be Mississippian. These included representatives of the genus Siphonodella. M. G. Mehl (personal communication) has indicated to me that he has obtained identifiable conodonts from the shale which bespeak Devonian age and that there are no indications of Mississippian age in the conodonts found so far. This section needs to be sampled and studied further before any definite correlation can be made between it and other sections.

Ste. Genevieve County.--The presence of the species found in the list above marks sample 549 as of Mississippian age. The other samples have only species which mark them as of late Devonian age. The occurrence of Palmatolepis distorta and Icriodus symmetricus in sample 549 should be considered the result of stratigraphic admixture (Branson and Mehl, 1941).

The section at Coal Hollow seems to be most closely related to the strata described and sampled by Woods (1955) and Quigley (1942). It has 19 species in common with the combined list of these authors (see table

2). The section at Coal Hollow also has 13 species in common with the section at Sees Creek. It would seem that this section (Coal Hollow) should be correlated with the sandstone facies of the Eureka shale and with the Sees Creek section. The sections at Dixie and Holt Summit do not seem to correlate with the Coal Hollow section, and it is possible that they are younger. The "Grassy Creek" group as it is herein listed also seems to be related to the development at Coal Hollow.

SUMMARY OF CONCLUSIONS

The boundary between the Devonian and the Mississippian can be located in the localities studied. At Coal Hollow, the sample numbered 548 has only Devonian species, whereas the sample numbered 549 has Mississippian species. The boundary lies between these two sandstones. At Sulphur Springs, the sandstone which was sampled yielded Mississippian conodont genera and species. The shale below it is known to yield Devonian species. The sandstone is the lowest Mississippian at that locality.

There are no faunal differences between the conodonts of the Devonian part of the Coal Hollow section, except those which might be considered to be the result of inadequacies of sampling, differences in treatment of samples in the laboratory, or differences in the abundance of conodonts in the several layers sampled. Likewise, there are no differences in the conodonts of the sandstones and the shales that may be interpreted as environmental responses. The differences which are present may be interpreted as being due to one or more of the factors listed above.

The formations or sections which the fauna of the Coal Hollow section suggests as time equivalents are the sandstone facies of the Eureka, the Sees Creek section, and the "Grassy Creek" group, which may be in part Saverton.

Table 1

32

Distribution of Conodonts by Samples (Ste. Genevieve County)
 Sample 546 was not productive and is not listed here.

	541	542	543	544	545	547	548	549
Family Prioniodidae								
Genus Hindeodella								
H. species								x
Genus Ligonodina								
L. acuta B.&M.	x	x						x
Genus Prioniodus								
P. barbatus B.&M.								x
P. confluent B.&M.			x					
P. obtusus B.&M.			x	x	x	x		
P. species			x					
Genus Trichonodella								
T. species			x		x			
Family Prioniodinidae								
Genus Bryantodus								
B. confragus B.&M.	x							
B. crassidens B.&M.	x	x		x				
B. species			x					
Genus Nothognathella								
N. abbreviata B.&M.	x							
N. (?) abnormis B.&M.								x
N. angusta Stauffer			x		x			
N. reversa B.&M.			x					
N. species A								x
N. species								x
Genus Ozarkodina								
O. regularis								x
O. species A			x					
O. species B								x
Genus Prioniodina								
P. aberrans n. sp.			x					
P. curvata B.&M.								x
P. species indet. A					x			
P. species indet. B			x					
P. species indet. C								x
Genus Pseudopolygnathus								
P. prima B.&M.								x
P. varicostata E. R. Branson								x

Table 1 (continued)

Distribution of Conodonts by Samples (Ste. Genevieve County)

	541	542	543	544	545	547	548	549
Genus <i>Solenodella</i>								
<i>S. costata</i> E. R. Branson								x
Genus <i>Spathognathodus</i>								
<i>S. species</i>							x	
Genus <i>Synprioniodina</i>								
<i>S. delicatula</i> B.&M.								x
Family Polygnathodidae								
Genus <i>Ancyrognathus</i>								
<i>A. bifurcata</i> (U.&B.)				x				
<i>A. irregularis</i> B.&M.		x	x	x			x	
<i>A. symmetrica</i> B.&M.	x	x		x	x			
<i>A. species</i>		x						
Genus <i>Palmatolepis</i>								
<i>P. delicatula</i> B.&M.							x	
<i>P. distorta</i> B.&M.							x	x
<i>P. glabra</i> U.&B.		x		x		x	x	
<i>P. minuta</i> B.&M.				x			x	
<i>P. perlobata</i> U.&B.		x	x	x	x		x	
<i>P. quadrantinodosa</i> B.&M.							x	
<i>P. subperlobata</i> B.&M.		x		x		x	x	
Genus <i>Polygnathus</i>								
<i>P. aperta</i> , n. sp.		x		x			x	
<i>P. communis</i> B.&M.								x
<i>P. distorta</i> B.&M.								x
<i>P. foliata</i> Bryant		x						
<i>P. inornata</i> E. R. Branson								x
<i>P. munita</i> , n. sp.							x	
<i>P. nodocostata</i> B.&M.		x					x	
<i>P. siphonata</i> , n. sp.	x	x	x	x			x	
<i>P. varinodosa</i> B.&M.		x		x				
<i>P. species</i>							x	
Family Gnathodidae								
Genus <i>Icriodus</i>								
<i>I. alternatus</i> B.&M.	x	x		x	x		x	
<i>I. symmetricus</i> B.&M.	x						x	x
<i>I. species A</i>				x			x	

Table 2

Distribution of Conodonts of Ste. Genevieve Suite in Other Formations

	Holt Summit	Sees Creek	Grassy Creek?	Sweetland Creek	New Albany	Chattanooga	Hardin	Eureka ss. facies (Woods & Quigley)
Family Prioniodidae								
Genus Hindeodella								
H. species								
Genus Ligonodina								
L. acuta B.&M.		x						
Genus Prioniodus								
P. confluens B.&M.		x	x					
P. obtusus B.&M.	x	x	x					x
P. species								
Genus Trichonodella								
T. species			x					
Family Prioniodinidae								
Genus Bryantodus								
B. confragus B.&M.		x						
B. crassidens B.&M.								x
B. species								
Genus Nothognathella								
N. (?) abnormis B.&M.		x						
N. abbreviata B.&M.		x	x					
N. angusta Stauffer								
N. reversa B.&M.	x	x	x					x
N. species A								
N. species								
Genus Ozarkodina								
O. species								
Genus Prioniodina								
P. aberrans n. sp.								x

Table 2 (continued)

Distribution of Conodonts of Ste. Genevieve Suite in Other Formations

	Holt Summit	Sees Creek	Grassy Creek?	Sweetland Creek	New Albany	Chattanooga	Hardin	Eureka ss. facies (Woods & Quigley)
<i>P. curvata</i> B.&M.								
<i>P. species</i> indet. A								
<i>P. species</i> indet. B								
<i>P. species</i> indet. C								
Genus <i>Spathognathodus</i>								
<i>S. species</i>								
Family Polygnathodidae								
Genus <i>Ancyrognathus</i>								
<i>A. bifurcata</i> (U.&B.)								x
<i>A. irregularis</i> B.&M.	x	x						
<i>A. symmetrica</i> B.&M.	x	x						
<i>A. species</i>								
Genus <i>Palmatolepis</i>								
<i>P. delicatula</i> B.&M.		x						
<i>P. distorta</i> B.&M.	x				x			x
<i>P. glabra</i> U&B.	x	x	x		x	x	x	x
<i>P. minuta</i> B.&M.	x				x		x	x
<i>P. perlobata</i> U.&B.	x	x	x	x	x	x	x	x
<i>P. quadrantinodosa</i> B.&M.	x		x					x
<i>P. subperlobata</i> B.&M.	x		x					x
<i>P. species</i>								
Genus <i>Polygnathus</i>								
<i>P. aperta</i> n. sp.								x
<i>P. foliata</i> Bryant								x
<i>P. munita</i> n. sp.								x
<i>P. nodocostata</i> B.&M.	x							x
<i>P. siphonata</i> n. sp.								x

Table 2 (continued)

Distribution of Conodonts of Ste. Genevieve Suite in Other Formations

	Holt Summit	Sees Creek	Grassy Creek?	Sweetland Creek	New Albany	Chattanooga	Hardin	Eureka ss. facies (Woods & Quigley)
<i>P. varinodosa</i> B.&M.	x	x						x
<i>P. species</i>								
Family Gnathodidae								
Genus <i>Icriodus</i>								
<i>I. alternatus</i> B.&M.			x					x
<i>I. symmetricus</i> B.&M.		x	x					x
<i>I. species A</i>								

Figure 1

37

Conodont Locality-Ste. Genevieve County, MissouriSample Columnar
No. Section

Lithologic Description

549

Buff to reddish brown sandstone, mostly quartz grains, some chert.

548

Buff and reddish brown sandstone, not very friable, chiefly quartz grains, angular to subrounded. Some chert-angular, gray and reddish brown.

547

Light gray to buff sandy shale, not fissile.

546

Hard black fissile shale.

545

Reddish brown sandstone, angular and subangular quartz grains, some chert; and dark gray shale.

544

Dark gray shale-evenly and finely laminated-some quartz grains. Few lenses of reddish brown sandstone interbedded at outcrop and interlaminated in hand specimen.

543

Dark gray shale-evenly and finely laminated-angular to subrounded quartz grains. Interbedded with reddish brown sandstone at outcrop and interlaminated in hand specimen.

542

White and reddish brown sandstone, grains mostly angular, some subrounded. Grains mostly quartz, some showing crystal faces, some chert-dark gray and reddish brown. Not very friable. Sample 541 is presumably the same as this layer.

540

Maquoketa shale?

Greenish gray shale, soft. No fossils were found in this layer.

Figure 2

38

Conodont Locality - Sulphur Springs, Missouri

Sample Columnar
No. Section

Lithologic Description

553

Sandstone, buff and reddish brown, mostly angular quartz grains, some chert.

552

Dark gray shale, fairly soft, not very fissile.

551

Dark gray shale, fissile. Phosphatic brachiopods observed.

550

Dark gray shale, fissile, hard. Phosphatic brachiopod observed.

Fernvale limestone. Not sampled.

DETAILS OF FAUNA

Family PRIONIODIDAE Ulrich and Bassler

Genus HINDEODELLA Ulrich and Bassler

Ulrich and Bassler's description:

Bar long and straight, bearing as many as ten small denticles in front of the strong long main cusp and a long series of numerous small slender denticles often alternating in size behind it, those of each set approximately equal in size.

Hindeodella sp.

Plate 2, Figure 4

Bar slender, somewhat laterally compressed, curved laterally, bearing rows of laterally compressed denticles, not separated by smaller denticles, which are posteriorly inclined. Anterior process curved inward, bearing denticles similar to those of the posterior bar in size and arrangement. All denticles visible to nearly the edge of the bar. Anterior and posterior terminations unknown.

Figured specimen.--Univ. of Mo. C954-3.

Occurrence.--Sample MGS-M 548, Ste. Genevieve Co., Mo.

Genus LIGONODINA Ulrich and Bassler

Branson and Mehl's description:

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 upward.

Branson and Mehl's revised description:

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 upward.

Ligonodina acuta Branson and Mehl

Plate 1, Figure 7

Ligonodina acuta Branson and Mehl, 1933, Univ. of Missouri Studies, vol. 8, no. 3, p. 200, pl. 15, fig. 32.

Ligonodina acuta Branson and Mehl, Branson, 1944, Univ. of Missouri Studies, vol. 19, no. 3, p. 163.

Ligonodina acuta Branson and Mehl, Youngquist, 1947, Jour. of Paleontology, vol. 21, no. 2, pp. 103-104, pl. 24, figs. 13, 19.

Branson and Mehl's description:

Terminal fang stout at its base, rapidly diminishing to slender, long, slightly recurved throughout its length, forming approximately a right angle with the posterior bar. Faint inner-anterior and outer-posterior ridges near the base become sharp lateral edges toward the apex. Antero-inferior process stout, directed in, down, and only very slightly forward with its thin terminus curved back and down. The

aboral edge of this process is thin and sharp without evidence of a median linear groove extending from the very minute subterminal fang pit. Denticles of this process about eight, subcircular in cross section, discrete. The lower four are very small, the others large and subequal. Posterior bar more or less blade-like with rounded oral edge and thin sharp aboral edge; denticles small, subcircular, isolated, slightly recurved.

Hypotype.--Univ. of Missouri, C954-4.

Occurrence.--Samples MGS-M 541, 542, 548, Ste.

Genevieve Co., Mo.

Genus PRIONIODUS Pander

Pander's description:

Wir vereinigen unter dieser Benennung alle diejenigen Zähne oder Kiefer, beideren ein sehr grosser Zahn in der Höhe hervorragt, und ihm an einer oder beiden Seiten eine Reihe kleinerer angereiht ist. Die hohle Basis erstreckt sich, der Länge nach, unter alle diese Zähne bis zu einer gewissen Höhe.

Translation (Roundy, 1926, p. 10):

We unite under this designation all those teeth or jaws in which a very large tooth juts forth, with a row of smaller ones arranged against it on one or both sides. The excavated base extends the entire length under these teeth to a certain height.

Branson and Mehl's revised description:

Units consisting of a more or less bar- or blade-like jaw piece (the oral Bar) which is straight or slightly arched and laterally curved; oral edge set with fairly uniform denticles, discrete or, rarely, fused; anterior end terminated by a denticle of large size which extends below the oral end so as to give to the unit as a whole a pick-like appearance. The terminal denticle or terminal fang is composed of several

fused denticles. There is commonly a slight excavation on the aboral edge at the union of the oral bar and the terminal fang, the upper lip of which is flared in most species.

Genotype.--Prioniodus elegans Pander.

Prioniodus confluens Branson and Mehl

Plate 1, Figure 13

Prioniodus confluens Branson and Mehl, 1933, Univ. of Missouri Studies, vol. 8, no. 3, p. 206, pl. 15, figs. 6, 7.

Branson and Mehl's description:

Bar short, thin, deep anteriorly, tapering rapidly to a point at the posterior end, slightly curved laterally, concave inward. Aboral margin straight in direct lateral view, sharp through the truncation of the inner lower part of the bar, forming a conspicuous facet extending from the posterior extremity to the base of the fang. Terminal fang very large, with antero-posterior width at the level of bar ranging from equal to half the length of the bar, markedly compressed with sharp fore-and-aft edges; anterior edge nearly straight. Aboral projection commonly but little less than length of bar, its posterior margin forming approximately a right angle with the latter. Aboral projection viewed in transmitted light seen to be composed of as many as eight or ten fused denticles. Base of fang proper showing its compound nature by transmitted light in some specimens. Inner side of fang base slightly extended lip-like about a shallow but well marked pit. Bar teeth about eight, decreasing regularly in length from the anterior end of the series, all of them more or less completely fused to produce a sharp oral margin the irregularities of which do not necessarily correspond with the individual denticles.

Hypotype.--Univ. of Missouri, C955-1.

Occurrence.--Sample MGS-M 542, Ste. Genevieve Co.,

Mo.

Prioniodus obtusus Branson and Mehl

Plate 1, Figure 12

Prioniodus obtusus Branson and Mehl, 1933, Univ. of Missouri Studies, vol. 8, no. 3, p. 205, pl. 15, figs. 4, 5.

Branson and Mehl's description:

Posterior bar comparatively long, blade-like, slightly curved to regularly convex on the outer surface. Aboral edge sharp through the truncation of the inner lower part, which forms a distinct facet extending from the posterior terminus to the base of the terminal fang, without evidence of longitudinal groove. Terminal fang nearly straight, laterally compressed, with sharp fore and aft edges. Antero-posterior width at level of bar about three times that of the bar teeth. The aboral projection of the lower anterior corner rounded, somewhat flattened, with its anterior edge flexed gently outward and extending somewhat less than the depth of the bar below its aboral edge. Two or three germ teeth are evident in transmitted light through the lower anterior edge of the terminal fang and in some specimens project very slightly on the anterior margin. Bar teeth short, slightly compressed laterally with sharp, almost confluent edges, evident as germ denticles in transmitted light almost to the lower edge of the bar. The number of bar denticles varies from about fourteen to eighteen. All are inclined to parallel the terminal fang.

Hypotype.--Univ. of Missouri, C954-5.

Occurrence.--Samples MGS-M 542, 543, 544, 545, Ste. Genevieve Co., Mo.

Prioniodus sp.

Plate 1, Figure 11

Bar of moderate depth, slightly arched and curved

laterally concave inward; aboral edge sharp through truncation of the lower inner surface by a facet extending the length of the bar. Terminal fang compressed with sharp anterior and posterior edges, with two or three germ denticles evident in transmitted light. Base of fang sharply flared on inner side to sharp lip, with ridge running down the inner side to a point on the lip, which overhangs a shallow pit. Bar denticles compressed, with sharp anterior and posterior edges. Germ denticles more numerous than terminations. Bar denticles discrete from near base to terminations.

Figured specimen.--Univ. of Missouri, C955-2.

Occurrence.--Sample MGS-M 542, Ste. Genevieve Co., Mo.

Genus TRICHONODELLA Branson and Mehl
(=TRICHONOGNATHUS Branson and Mehl)

Branson and Mehl's description:

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.

Genotype. Trichonodella prima Branson and Mehl.

Trichonodella sp.

Plate 1, Figure 20

Apical denticle stout, not laterally compressed, with grooves running upward from its base. Base expanded, deeply excavated, with grooves extending into the posterior and lateral extensions. Bar bears stout, rounded denticles. Terminations of bar and posterior extension unknown.

Figured specimen.--Univ. of Missouri, C955-3.

Occurrence.--Samples MGS-M 542, 544, Ste. Genevieve Co., Mo.

Family PRIONIODINIDAE Ulrich and Bassler

Genus BRYANTODUS Ulrich and Bassler

Ulrich and Bassler's description:

Like Prioniodina, but denticles with sharp, laterally confluent edges. The main cusp is proportionately much larger and as a rule more conspicuous in its width and broadly expanded sides confluent with the adjacent denticles. The base forms a narrow flange-like expansion on both sides, with a characteristic downward projection on the inner side beneath the main cusp, serving perhaps for securing attachment in the jaw of the animal. The denticles are connected by a membrane-like extension of their edges, a feature much better developed in this genus than in the otherwise related genus Prioniodina.

Branson and Mehl's revised description:

Base asymmetrically arched, more bar-like than blade-like, with width about the same as or less than depth, and of a triangular cross

section in which one corner represents the aboral edge and the other two represent the limited lateral expansion of the oral side, from which the oral denticles rise more or less abruptly. Aboral side sharp-edged or flattened, with a faint keel which is interrupted at the apex of the arch by a pit of varying size, in most species very small. Oral surface smooth or simply tuberculate or nodose at the margins; greatest width at or near the apex with a sharp increase here in the width of some species through a lateral or lateral and downward lip-like extension of one side. Oral denticles laterally compressed, sharp-edged, more or less confluent, in some specimens completely fused and in others with short limb denticles, discrete immediately above the base. All inclined to parallel an exceptionally large apical denticle which forms an angle of about 90 degrees or less with one, usually the shorter, limb.

Genotype.--Bryantodus typicus Ulrich and Bassler.

Bryantodus confragus Branson and Mehl

Plate 1, Figure 15

Bryantodus confragus Branson and Mehl, 1933, Univ. of Missouri Studies, vol. 8, no. 3, p. 218, pl. 16, fig. 8.

Branson and Mehl's description:

Base broad and plate-like with rounded inner edges, broadly arched, with posterior limb about two-thirds as long as anterior limb and somewhat more sharply bent downward. Aboral side of anterior limb bluntly edged, posterior limb sharp. Apical pit conspicuous, pointed and somewhat elongate antero-posteriorly, about mid-width in position, without conspicuous lips. Separate oral denticles obscure, almost completely fused into an irregular-edged, blade-like crest with only oral projections or slight fluting on the sides to indicate the number. About ten denticles on the anterior limb, of subequal length, all short. At the

apex of the arch are three or four fused denticles, which rise abruptly above the posterior and anterior series. This unit is buttressed on the inner side by a low sharp lateral wing. Posterior denticles about eight, somewhat shorter than those of anterior series, less compressed and somewhat more distinct. The entire oral series confluent with the outer side of the base except at the anterior third, where a narrow shelf is formed by the base, which is nodose along its outer edge. Shelf on inner side wide at mid-length, tapering to the denticle row at about mid-length of each arch limb; anterior part nearly smooth, posterior part nodose with a tendency toward transverse arrangement.

Hypotype.--Univ. of Missouri, C955-4.

Occurrence.--Sample MGS-M 541, Ste. Genevieve Co.,

Mo.

Bryantodus crassidens(?) Ulrich and Bassler

Plate 1, Figure 8

Bryantodus crassidens (?) Ulrich and Bassler, Branson and Mehl, 1933, Univ. of Missouri Studies, vol. 8, no. 3, pp. 218, 219, pl. 16, figs. 3, 5, 6, 7, 21.

Branson and Mehl's description:

Base broadly arched with anterior limb about a third longer than posterior limb. Aboral edge sharp, apical pit circular, of moderate size, without conspicuous lip. Oral surface of base laterally expanded from tapered ends to an appreciable mid-length width. Denticles closely bordering outer side. Denticles of anterior limb about eight, laterally compressed, sharp-edged, confluent through much of their length, of variable size, but in general smaller near the anterior end. Apical denticle considerably longer than the others, sharp-edged, and only slightly compressed. Denticles of posterior limb about four, laterally compressed, partially confluent, subequal, conspicuously shorter than those of the anterior limb.

Hypotype.--Univ. of Missouri, C955-5.

Occurrence.--Samples MGS-M 541, 542, 544, Ste. Genevieve Co., Mo.

Bryantodus sp.

Plate 1, Figure 14

Unit thick, lateral flanges extending the length of the blade on both sides. One flange better developed than other, bears sharp nodes on its margin. Denticles of anterior limb about six, subcircular, blunt, closely approximated, increasing in size posteriorly. Aboral side with sharp keel. Smaller flange granulose at margin. Major denticle not much larger than the adjacent denticles. Posterior limb unknown.

Figured specimen.--Univ. of Missouri, C956-1.

Occurrence.--Sample MGS-M 544, Ste. Genevieve Co., Mo.

Genus NOTHOGNATHELLA Branson and Mehl

Branson and Mehl's description:

An arched basal bar; the oral edge of one limb produced into fairly uniform, relatively short, pointed, laterally compressed, sharp-edged, confluent denticles. The sides of this limb are produced laterally into an outer and an inner flange or plate, the inner of which is usually appreciably the larger. The other limb is conspicuously blade-like through the union of relatively long denticles on the oral edge, the largest of which are at or near the posterior end of the series or the apex of the arch. On the aboral edge of the arch a keel

of varying strength, commonly interrupted at the apex of the arch by a small pit, marks the position of the row of oral denticles.

Genotype.--Nothognathella typicalis Branson and Mehl.

Nothognathella abbreviata Branson and Mehl

Plate 1, Figure 5

Nothognathella abbreviata Branson and Mehl, 1933, Univ. of Missouri Studies, vol. 8, no. 3, p. 229, pl. 13, fig. 15.

Branson and Mehl's description:

Base moderately and regularly arched, anterior limb longer than posterior limb. Aboral side flattened or broadly rounded at the arch apex; flattening continues on the posterior limb, along which a low median keel extends from a much elongate apical pit; aboral side of anterior limb sharp. Denticles of anterior series about ten, subequal, compressed, fused to near their apices; the posterior unit is somewhat wider than the others and marks the apex of the arch. Denticles of posterior series about eight, compressed, coalesced to near apices, very short except one or two that form the transition to the anterior series. Inner flange short and widely expanded with nodose raised rim, confined to the posterior limb. On the anterior limb the denticles are flush with the inner face of the base except that there is a slight basal flare at the posterior end of the series that makes the offset of the posterior flange less conspicuous. Flange of outer side very narrow, extending across the arch and part of the way along both limbs. Margin crenulate or nodose at mid-length.

Hypotype.--Univ. of Missouri, C 956-2.

Occurrence.--Sample MGS-M 541, Ste. Genevieve Co.,

Mo.

Nothognathella (?) abnormis Branson and Mehl

Plate 1, Figure 1

Nothognathella (?) abnormis Branson and Mehl, 1933, Univ. of Missouri Studies, vol. 8, no. 3, pp. 231, 232, pl. 14, figs. 1, 2.

Nothognathella (?) abnormis Branson and Mehl, Youngquist and Miller, 1948, Jour. Paleontology, vol. 22, no. 4, p. 447, pl. 67, fig. 5.

Branson and Mehl's description:

Base bar-like, highly and regularly arched, with anterior limb nearly twice as long as posterior limb and arch bent laterally at the apex to produce a concave inner face. Aboral edge of base sharp with a very small apical pit and a small lip-like extension of the base about the outer (convex side of the arch) side. Oral side of base occupied by denticles except on the inner side, where it is offset from the base of the denticles by a very narrow shelf or ridge with rounded edge. Denticles of anterior limb about twelve, laterally compressed, with sharp edges, confluent to near the apices, subequal in length and size. There is no distinct apical denticle, although one or two at the apex of the arch may be large in some specimens. Denticles of posterior limb about ten, somewhat compressed, confluent to near apices, subequal, short except for an abrupt rise of the anterior few immediately behind the apex of the arch.

Hypotype.--Univ. of Missouri, C956-3.

Occurrence.--Sample MGS-M 548, Ste. Genevieve

Co., Mo.

Nothognathella angusta Stauffer

Plate 1, Figure 10

Nothognathella angusta Stauffer, 1938, Jour. Paleontology, vol. 12, no. 5, p. 435, pl. 18, fig. 34.

Stauffer's description:

Base slightly arched and bowed, broad, relatively shallow, flattened beneath cusp but weakly keeled towards extremities. Outer margin with a rounded carina on anterior limb, becoming angular towards center, then expanding into a narrow shelf, which is papillose and widest just posterior to cusp. Inner carina develops into a broadly arched slightly papillose flange, widest just anterior to cusp. Anterior limb bears 13 or 14 laterally compressed; closely appressed denticles, confluent nearly to apices. Posterior limb with eight or ten much shorter but closely set stout denticles decreasing in size posteriorly. Cusp stout and well developed but scarcely distinguishable from the two succeeding anterior denticles.

Hypotype.--Univ. of Missouri, C956-4.

Occurrence.--Sample MGS-M 542, Ste. Genevieve Co., Mo.

Nothognathella reversa Branson and Mehl

Plate 1, Figure 2

Nothognathella reversa Branson and Mehl, 1933, Univ. of Missouri Studies, vol. 8, no. 3, p. 231, pl. 13, figs. 9, 10.

Branson and Mehl's description:

Apex of arch moderately curved. Anterior limb somewhat longer than posterior limb, nearly straight; posterior limb slightly flexed upward and inward at its posterior end. The aboral keel is thin and comparatively low but clearly differentiated, with a small but marked sharp-rimmed pit at the apex of the arch. Outer flange narrow but distinct, extending from terminus of posterior limb nearly the length of the anterior limb, but more ridge-like and unornamented anteriorly from its widest part just back of the arch apex; posterior half

slightly tubercular or granulose along the free margin. Inner flange distinct nearly to the ends of the limbs but ridge-like toward its extremities; a considerable width of flange just back of the arch apex caused by the outward lateral swing of the denticles; posterior half of oral surface marked with small, sharp, irregularly disposed tubercles, the other parts smooth. Posterior series of oral denticles about ten to twelve, small, uniform in size except for a gradual increase to maximum at the anterior end, somewhat peg-like and distinct but closely approximated. Anterior series of about ten, somewhat peg-like and closely approximated, or laterally compressed and fused to near their apices; somewhat irregular in size with a general increase in length from very short to long up to the last or last but one of the series; the last of the anterior series is exceptionally long and large, sharp-edged, keeled, and apical in position.

Hypotype.--Univ. of Missouri, C956-5.

Occurrence.--Sample MGS-M 542, Ste. Genevieve Co.,

Mo.

Nothognathella sp. A

Plate 1, Figure 19

Unit slightly arched longitudinally, slightly flexed laterally. Posterior limb bearing about four discrete denticles, decreasing in size posteriorly. Inner lateral ridge strong but not shelf-like, outer lateral ridge shelf-like and granulose. Posterior limb fairly flat, granulose. At the junction of the limbs is a very large, laterally compressed denticle. A low keel divides each limb unevenly. At the apex of the arch a very small pit is found.

Figured specimen.--Univ. of Missouri, C957-1.

Occurrence.--Sample MGS-M 548, Ste. Genevieve Co.,

Mo.

Nothognathella sp.

Plate 1, Figure 6

Unit slightly arched, slightly sinuous laterally. Anterior limb bears about six closely packed, peg-like denticles, decreasing in size posteriorly. Posterior limb bears about five peg-like, less closely packed denticles. Aboral edge sharp, with a pit of moderate size at the apex of the arch. Inner lateral flange not well developed, but extending nearly the length of the tooth. Outer lateral flange turned aborally, sinuous at edge, extending nearly the length of the tooth, widest at the apex of the arch. A large denticle marks the apex, is slightly laterally compressed, and about twice as large as the limb denticles.

Figured specimen.--Univ. of Missouri, C957-2.

Occurrence.--Sample MGS-M 544, Ste. Genevieve Co.,

Mo.

Genus OZARKODINA Branson and Mehl

Branson and Mehl's description:

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 to actually sheathed. Base excavated beneath large denticle.

Genotype.--Ozarkodina typica Branson and Mehl.

Ozarkodina sp. A

Plate 1, Figure 4

Unit slightly arched, slightly flexed laterally. Anterior limb bearing laterally compressed denticles which are sheathed through about half of their length. Major denticle about twice the size of the limb denticles. Aboral edge with a sharp keel and a small pit at mid-length. Posterior limb unknown.

Figured specimen.--Univ. of Missouri, C957-3.

Occurrence.--Sample MGS-M 544, Ste. Genevieve Co., Mo.

Ozarkodina sp. B

Plate 1, Figure 3

Unit moderately arched, flexed laterally. Denticles of anterior limb about ten, decreasing in size anteriorly, laterally compressed, sheathed through about half their length, visible nearly to the base of the tooth. Major denticle laterally compressed, inclined posteriorly, seeming to crowd out the limb denticles, about three times as wide as the limb denticles. Aboral edge with small pit.

Posterior limb unknown.

Figured specimen.--Univ. of Missouri, C957-4.

Occurrence.--Sample MGS-M 548, Ste. Genevieve Co.,
Mo.

Genus PRIONIODINA Ulrich and Bassler

Ulrich and Bassler's description:

Base of tooth more or less curved, crowned with numerous, subparallel, rounded, discrete denticles all inclined in one direction, one of which located in the median third, is considerably larger than the others.

Genotype.--Prioniodina subcurvata Ulrich and Bassler.

Prioniodina aberrans Smoot, n. sp.

Plate 1, Figure 9

Bar compressed, slightly curved laterally, strongly arched. On the aboral side a large pit with sharp lips is found at the apex of the arch. Aboral side rounded, becoming somewhat sharp anteriorly. A small groove extends posteriorly from the pit. The major denticle has about twice the size of the adjacent denticles, and is located over the large pit. The denticles of the posterior limb vary in size, are laterally compressed, may be pressed against each other or may be isolated. The denticles of the anterior limb are similar to those of the posterior limb, but are commonly separated from each other by a

slight gap.

Holotype.--Univ. of Missouri, C957-5.

Occurrence.--Sample MGS-M 542, Ste. Genevieve Co., Mo.

Prioniodina curvata Branson and Mehl

Plate 1, Figure 16

Prioniodina curvata Branson and Mehl, 1933, Univ. of Missouri Studies, vol. 8, no. 3, p. 214, pl. 14, fig. 17.

Branson and Mehl's description:

Base distinctly blade-like with sharp aboral edge except for a wide flattening or actual concavity beneath the apical denticle; highly and somewhat sharply arched, with the shorter limb straight and the other curved downward; limbs sharply offset laterally just behind the apical denticle. Denticles of longer limb about seven, subcircular, well separated, somewhat variable in size. Apical denticle circular, recurved, considerably longer than the others and of about twice the diameter of the larger limb denticles. Denticles of the shorter (posterior) limb about four, similar to those of the anterior limb.

Hypotype.--Univ. of Missouri, C958-1.

Occurrence.--Sample MGS-M 548, Ste. Genevieve Co., Mo.

Prioniodina sp. indet. A

Plate 2, Figure 8

Unit sharply arched, slightly curved laterally. Anterior limb bearing nearly circular, discrete denticles. Major denticle slightly compressed laterally. Posterior limb unknown. Aboral edge sharp, with pit of moderate size.

Figured specimen.--Univ. of Missouri, C958-2.

Occurrence.--Sample MGS-M 544, Ste. Genevieve
Co., Mo.

Prioniodina sp. indet. B

Plate 1, Figure 17

Unit moderately arched, sharply curved laterally. Both limbs bear discrete denticles, laterally compressed, closely packed to the adjoining denticles. Major denticle laterally compressed, nearly twice as large as the adjoining denticles. Aboral edge sharp, with small pit.

Figured specimen.--Univ. of Missouri, C958-3.

Occurrence.--Sample MGS-M 544, Ste. Genevieve
Co., Mo.

Prioniodina sp. indet. C

Plate 2, Figure 5

Unit sharply arched, curved laterally. Posterior limb bearing short, laterally compressed denticles which decrease in size posteriorly. Anterior limb bearing short, laterally compressed denticles similar to those of the posterior limb. Major denticle about three times the size of the adjacent limb denticles. Aboral edge sharp, with small pit. Terminations of limbs unknown.

Figured specimen.--Univ. of Missouri, C958-4.

Occurrence.--Sample MGS-M 548, Ste. Genevieve Co.,

Mo.

Genus SPATHOGNATHODUS (Branson and Mehl)
(=SPATHODUS, Branson and Mehl)

Branson and Mehl's description:

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 cuplike excavation or navel, which ranges in shape from slightly elongate antero-posterior, 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.

Spathognathodus sp.

Plate 1, Figure 18

Blade very large, laterally curved. Outline of oral edge in lateral view slightly arched. Aboral edge with very large, more or less cross-shaped, fairly deep pit. The lateral expansions of the lower edge are very conspicuous, with rounded terminations. The outer-lateral extension bends slightly backward. Both lateral extensions bear numerous nodes reaching the level of the oral denticles of the blade. Oral denticles small, subequal, closely set.

Figured specimen.--Univ. of Missouri, C963-3.

Occurrence.--Sample MGS-M 548, Ste. Genevieve Co.,
Mo.

Family POLYGNATHODIDAE

Genus ANCYROGNATHUS Branson and Mehl

Branson and Mehl's description:

Dental unit consisting of a plate nodose on the oral side and smooth on the aboral. The plate forks at the back end into two subequal lobes. A strong carina runs the length of the plate and becomes a short blade in front; at the back it forks, a branch running to the tip of each posterior lobe. Nodose ridges bisect other lobes when they are present. The aboral side of each lobe is bisected by a keel.

Genotype.--Ancyrognathus symmetrica Branson and Mehl.

Ancyrognathus bifurcata (Ulrich and Bassler) Smoot

Plate 2, Figure 22

Palmatolepis bifurcata Ulrich and Bassler, 1926, Proc. of the U. S. Nat. Mus., vol. 68, art. 12, p. 50, pl. 7, figs. 16, 17.

Ulrich and Bassler's description:

Lower and upper surface of two examples showing the distinct and characteristic subequal bifurcation of the median crest. Upper surface strongly tuberculated without definite arrangement; under surface concentrically striated and ridged similar to the upper surface.

Remarks.--The writer has not redescribed the species

because Ulrich and Bassler's holotype was not available for study. It seems likely that there may be considerable variation in the species.

Hypotype.--Univ. of Missouri, C958-5.

Occurrence.--Sample MGS-M 544, Ste. Genevieve Co., Mo.

Ancyrognathus irregularis Branson and Mehl

Plate 2, Figure 24

Branson and Mehl's description:

Plate arrow-shaped to leaf-shaped, a little longer than wide. In some specimens the posterior lobes are subequal, in others decidedly unequal. Oral side slightly and uniformly convex, the entire surface nodose, nodes small and some specimens with the nodes in ridges. The carina is low and of nearly uniform thickness, and the branches bisect the posterior lobes. In some specimens the carina nodes near the apex of the lobes are high and tooth-like. The blade is short and high. The aboral side of the plate is smooth. Fine concentric lines have the place of forking of the keel as the center about which they run. The keel is lowest in the center and increases in height and thickness toward the tips of the lobes. The pit is small and a short groove extends into each branch of the keel.

Hypotype.--Univ. of Missouri, C959-1.

Occurrence.--Samples MGS-M 542, 543, 544, 548
Ste. Genevieve Co., Mo.

Ancyrognathus symmetrica Branson and Mehl

Plate 2, Figure 25

Branson and Mehl's description:

Plate of medium thickness, subarrow-shaped, about twice as long as wide. Oral side nearly plane, save for the irregularities produced by the nodes and the carina. The carina extends to the ends of both posterior lobes and is of nearly uniform height and width to about mid-length of the tooth, where the plate turns sharply aborad, but the top of the carina stays in the same plane as behind and becomes much higher; it extends about one-fifth the length of the tooth in front of the plate to form a short blade. The entire oral surface is ornamented with nodes in irregular groups or ridges. A row on each side of the carina extends nearly parallel to it on the anterior half of the plate. On the sides between these rows and the posterior branches of the carina the nodes are irregular and range in number from about four to about twenty. The posterior branches of the carina are on the inner edges of the lobes and have no nodes between them in some specimens, while in other specimens a narrow part of the plate between the branches bears a few nodes. The aboral side of the plate is smooth, but very fine concentric lines are visible under the 40 power microscope. The keel is low but distinct, the posterior branches about the same length as the anterior; the pit is small and shallow. The angle between the posterior branches of the keel ranges from 50 degrees to 80 degrees.

Hypotype.--Univ. of Missouri, C959-2.

Occurrence.--Samples MGS-M 541, 542, 544, 545,
Ste. Genevieve Co., Mo.

Ancyrognathus sp.

Plate 2, Figure 26

Plate elongate, convex on oral side, smooth on

aboral side, slightly arched longitudinally. Carina moderately high, bifurcates, bisecting each lobe. Edges of each lobe nodose, plate smooth on oral side between the edges and the carina. Keel fairly high, sharp, bifurcating and bisecting each lobe. Aboral pit small, with concentric growth lines surrounding it.

Figured specimen.--Univ. of Missouri, C959-3.

Occurrence.--Sample MGS-M 542 Ste. Genevieve Co., Mo.

Genus PALMATOLEPIS Ulrich and Bassler

Ulrich and Bassler's description:

Plate more or less irregularly palmate, the crest curved and bifurcating in its upper half so as to extend a division into each of the two main lobes and its lower end not extending beyond the narrowing lateral areas. Upper surface highly ornamented, usually with radially or otherwise arranged rows of minute tubercles. Under surface with concentric growth lines and low ridges corresponding to the bifurcated crest of the upper surface.

Genotype.--Palmatolepis perlobata Ulrich and Bassler.

Palmatolepis delicatula Branson and Mehl

Plate 2, Figure 12

Palmatolepis delicatula Branson and Mehl, 1933, Univ. of Missouri Studies, vol. 8, no. 3, p. 237, pl. 18, figs. 4, 10.

Branson and Mehl's description:

Plate very thin, slightly and irregularly warped. Margin of the narrow side a nearly uniform curve with the arc of the front part longer than that of the back. Opposite side a well developed lobe bounded by gently concave margins and rounded at the tip. The lobed side extends farther on the blade than the narrow side. The carina originates near the back end of the plate, but is an indistinct ridge which increases slightly in width and height to about the middle of the plate, where it rises and widens abruptly. In front of the azygous node denticles join to form the carina, and become thinner and higher, passing into the short blade without line of demarcation. The oral surface appears smooth but under high power shows fine pitting--more than 6000 pits to a square millimeter. The side with the wide lobe is gently concave, the deepest part of the concavity next the carina; the narrow side is flat to gently concave. The back end of the carina is in a groove and the groove continues to the back end of the plate. The aboral side of the plate is smooth, with a low narrow keel opposite the carina. The lobed side runs the entire length of the keel and the keel projects little below it. The narrow side turns oral near the middle making a sharp offset along the keel at the front. The bottom of the blade forms a distinct ridge at the front of the tooth. The keel is slightly offset at the usual location of the pit, but no pit is present.

Hypotype.--Univ. of Missouri, C959-4.

Occurrence.--Sample MGS-M 548, Ste. Genevieve Co., Mo.

Palmatolepis distorta Branson and Mehl

Plate 2, Figure 10

Palmatolepis distorta Branson and Mehl, 1933, Univ. of Missouri Studies, vol. 8, no. 3, pp. 237-238, pl. 18, figs. 13, 14.

Branson and Mehl's description:

Plate thick and very narrow in proportion to length, strongly curved and twisted at the posterior end. Azygous node small and little different from the carina nodes. Carina high in front of it, increasing gradually in height to the front end, which does not extend in front of the plate. Behind the azygous node the carina extends only a short distance and is made up of three or four nodes which decrease in size toward the back. Back of the carina a groove continues to the end of the plate. On the convex edge of the plate a thin parapet the same height as the carina parallels it for about one-third the length of the plate, leaving a deep narrow groove between. The plate extends little in front of the parapet. Behind the parapet the plate becomes very thin and is uniformly convex transversely. On the opposite edge of the plate from the parapet the surface is strongly convex, dropping away steeply to the margin. The oral surface of the plate is marked with very fine sinuous, discontinuous, inosculating ridges.

The aboral surface is a trough with flaring sides behind, which shallows toward the front and has no boundary margin on one side, while the keel forms the other boundary. The keel is high in front but decreases until it is faint opposite the azygous node and is scarcely distinguishable behind the node.

Hypotype.--Univ. of Missouri, C959-5.

Occurrence.--Sample MGS-M 548, Ste. Genevieve Co.,

Mo.

Palmatolepis glabra Ulrich and Bassler

Plate 2, Figure 14

- Palmatolepis glaber* Ulrich and Bassler, 1926, Proc. U. S. Nat. Mus., vol. 68, p. 51, pl. 9, figs. 18-20.
Palmatolepis elongata Holmes, 1928, Proc. U. S. Nat. Mus., vol. 72, p. 33, pl. 11, fig. 13.
Palmatolepis glabra Ulrich and Bassler, Branson and Mehl, 1933, Univ. of Missouri Studies, vol. 8, p. 233, 234, pl. 18, figs. 9, 22, 26.

- Palmatolepis elongata* Holmes, Huddle, 1934, Bull. Am. Paleontology, vol. 21, no. 72, pp. 107-108, pl. 9, figs. 8-10.
- Palmatolepis elongata* Holmes, Cooper, 1935, Jour. Paleontology, vol. 9, no. 4, pp. 310, 314, pl. 27, fig. 40.
- Palmatolepis glabra* Ulrich and Bassler, Branson and Mehl, 1941, Bull. Denison Univ., vol. 40, no. 14, pp. 192-193, pl. 7, figs. 13, 15, 16.
- Palmatolepis glabra* Ulrich and Bassler, Cooper and Sloss, 1943, Jour. Paleontology, vol. 17, no. 2, p. 17, pl. 29, figs. 5, 36.
- Palmatolepis glabra* Ulrich and Bassler, Branson, 1944, Univ. of Missouri Studies, vol. 19, no. 3, pp. 157, 163, pl. 28, figs. 15, 42, 51.
- Palmatolepis glabra* Ulrich and Bassler, Bond, 1947, Ohio Jour. Sci., vol. 47, no. 2, pp. 21, 33, pl. 2, fig. 25.
- Palmatolepis glabra* Ulrich and Bassler, Thomas, 1949, Geol. Soc. Am. Bull., vol. 60, no. 3, p. 408, pl. 1, fig. 19.

Branson and Mehl's description:

Plate thin in small specimens, thick in large; narrow in proportion to length, the larger specimens proportionally wider. One margin uniformly sigmoidal, the other margin, bounding the narrower side of the plate, subparallel to it for two-thirds the length of the plate, there turning at right angles to join the carina and truncate that side of the plate. Just in front of the azygous node the narrow side of the plate folds inward to become as high or higher than the carina.

The carina originates near the posterior end of the plate and passes forward in a straight or slightly curved line to the azygous node. In front of the node the carina curves in the opposite direction and grades into a short blade without line of demarcation. The back part of the carina is made up of about ten nodes that increase in height and diameter to the azygous node. In front of the azygous node twenty to twenty-five united denticles make up the carina and the blade. The blade is thicker than the carina and has plate on only one side of it. The surface of the plate is marked with very fine longitudinal sinuous reticulate ridges, about fifty to a millimeter.

The aboral side of the plate is nearly plane,

save for a concavity opposite the infolded part of the narrow side of the plate, and a faint keel corresponding in position to the carina on the oral side.

Hypotype.--Univ. of Missouri, C960-1.

Occurrence.--Samples MGS-M 542, 544, 548, Ste. Genevieve Co., Mo.

Palmatolepis minuta Branson and Mehl

Plate 2, Figure 11

Palmatolepis minuta Branson and Mehl, 1933, Univ. of Missouri Studies, vol. 8, no. 3, p. 236, 237, pl. 18, figs. 1, 6, 7.

Palmatolepis minuta Branson and Mehl, Huddle, 1934, Bull. Am. Paleontology, vol. 21, no. 72, pp. 109-110, pl. 9, fig. 24.

Palmatolepis minuta Branson and Mehl, Ellison and Graves, 1941, Univ. of Missouri, School Min. and Met. Bull., Tech. Ser., vol. 14, no. 3, pp. 3, 4, pl. 2, fig. 25.

Palmatolepis minuta Branson and Mehl, Branson, 1944, Univ. of Missouri Studies, vol. 19, no. 3, pp. 153, 158, pl. 26, fig. 25.

Branson and Mehl's description:

The length of the cotypes does not exceed seven-tenths of a millimeter. The plate is nearly bilaterally symmetrical in outline. The carina is very low and faint back of the azygous node, consisting of four or five extremely small nodes, and becomes obsolete about half to two-thirds the length of the posterior lobe. In front of the azygous node the carina is high and is made up of about twelve slender denticles. Some specimens have a blade of large size compared to the size of the plate and others have no blade extension in front of the plate. The azygous node is an almost symmetrical slender cone. The oral surface of the plate is nearly flat but has a shallow longitudinal trough bisecting the back lobe. The surface is smooth.

The aboral side of the plate is plane save for the downturning of the back end and the ridge

formed by the keel. The plate on each side of the keel is a mirror duplicate of the other save for a very slight sigmoidal twist. The keel is very slender and low on the back lobe excepting near the tip, but higher and much stronger on the front lobe.

Hypotype.--Univ. of Missouri, C960-2.

Occurrence.--Samples MGS-M 544, 548, Ste. Genevieve Co., Mo.

Palmatolepis perlobata Ulrich and Bassler

Plate 2, Figure 9

Palmatolepis perlobata Ulrich and Bassler, 1926, Proc.

U. S. Nat. Mus., vol. 68, p. 49, pl. 7, figs. 19-23.

Palmatolepis peculiaris Ulrich and Bassler, 1926, Proc.

U. S. Nat. Mus., vol. 68, p. 51, pl. 8, figs. 11, 12.

Palmatolepis perlobatus Ulrich and Bassler. Holmes, 1928, Proc. U. S. Nat. Mus., vol. 72, p. 34, pl. 11, figs. 16-19.

Branson and Mehl's description:

Plate thin, almost flat, but slightly twisted so as to form several shallow concavities and convexities on each side. Outline on one edge strongly convex in the middle, straight or slightly concave near the extremities. Outline of the opposite edge gently convex for the posterior third, strongly lobed for the middle third, nearly straight for the anterior third. The carina extends the full length of the plate, gradually increasing in height forward to form a short blade that projects a little in front of the plate. At the posterior end the carina is made up of very small nodes which increase slightly in height and diameter to an azygous node about one-third the length of the plate from the back. The azygous node is higher and of larger diameter than any of the adjacent nodes. Just in front of it the nodes increase in height and breadth, rapidly forming flat denticles that make a blade several times as high as the azygous node. Oral surface of plate covered with low subcircular to elongate nodes

some of which form ridges that radiate from the region of azygous node. From the azygous node a low ridge made up of indistinct nodes projects toward the tip of the side lobe, becoming obsolete somewhere between the node and the outer one-fourth of the lobe. The aboral side of the plate is nearly smooth, but indistinct concentric growth lines appear around the pit opposite the azygous node. A low keel runs the entire length of the plate just opposite the carina but is highest at the posterior end where the carina is lowest. On some specimens a low ridge extends inward from the tip of the lobe reaching to the longitudinal ridge or becoming obsolete in most or all of the middle part of the plate.

Hypotype.--Univ. of Missouri, C960-3.

Occurrence.--Samples MGS-M 542, 543, 544, 545, 548, Ste. Genevieve Co., Mo.

Palmatolepis quadrantinodosa Branson and Mehl

Plate 2, Figure 15

Palmatolepis quadrantinodosa Branson and Mehl, 1933, Univ. of Missouri Studies, vol. 8, no. 3, p. 235, 236, pl. 18, figs. 3, 17, 20.

Branson and Mehl's description:

Plate slightly undulating, wide in proportion to length, suboval in outline. The longer margin sigmoidal, the shorter nearly straight in the posterior two-thirds, thence sharply rounded to meet the blade.

The carina originates at or near the posterior end of the plate and passes forward in a straight line to the azygous node. It is made up of about six small distinct nodes that increase in size forward. The azygous node is broad and low. In front of it the carina turns sharply toward the narrow side of the plate and passes forward nearly parallel to the margin. The denticles become higher and smaller in diameter forward. In front of the place where

the plate terminates on one side the continuation of the carina becomes the blade. It is narrower and somewhat higher than the front part of the carina and is made up of about ten denticles. The oral surface of the plate is marked with granules or very slender sinuous ridges which run almost normal to the carina, excepting the front half of the short side of the plate, which bears distinct nodes either closely crowded or sparsely distributed. Aboral side of plate a contorted trough bounded on one side by a parapet formed by the base of the blade in front and the down-turned edge of the plate behind; the posterior part of the trough deflected orad, the shorter side without parapet. The keel is almost obsolete.

Hypotype.--Univ. of Missouri, C960-4.

Occurrence.--Sample MGS-M 548, Ste. Genevieve Co.,

Mo.

Palmatolepis subperlobata Branson and Mehl

Plate 2, Figure 7

Palmatolepis subperlobata Branson and Mehl, 1933, Univ. of Missouri Studies, vol. 8, no. 3, p. 235, pl. 18, figs. 11, 21.

Branson and Mehl's description:

Plate very thin, nearly flat but slightly twisted on the narrow side. Narrow side of nearly uniform width, margin convex, the main convexity opposite the middle of the tooth, slightly concave, straight, or slightly convex forward. Broad side with a nearly symmetrical lobe, strongly concave on each side, projecting strongly in the middle. Surface smooth save for very small nodes and ridges. The carina extends the full length of the plate, in some specimens becoming obsolete near the back end. Behind the azygous node it is nearly straight but starts a gentle curve that ends a short distance in front of the node and thence continues almost straight to the blade. The denticles making up the carina increase uniformly in height from

the most posterior to the most anterior with the exception of the azygous node, which is higher and of much larger diameter than the others near it. A faint ridge bisects the lateral lobe in most specimens. The blade makes up a little less than one-third the length of the tooth. The oral surface is minutely granulose, about seventy granules in a distance of one millimeter, the granules tending to unite in short sinuous ridges.

Aboral side smooth; keel low and narrow, but highest at the extremities; pit absent; a faint ridge bisects the lateral lobe of most specimens.

Hypotype.--Univ. of Missouri, C960-5.

Occurrence.--Samples MGS-M 542, 544, 548, Ste.

Genevieve Co., Mo.

Palmatolepis sp.

Plate 2, Figure 6

Plate thin, wide in proportion to length, slightly warped. Carina composed of small fused nodes, ending just posterior to the azygous node. Plate granulose. Outer posterior margin curved gently, turning sharply into blade at anterior end, forming a trench next to the carina. Inner posterior margin curved, making a rounded lobe opposite to azygous node, curving rapidly toward carina anteriorly. Aboral side with a very small keel corresponding in position to that of the carina.

Figured specimen.--Univ. of Missouri, C961-1.

Occurrence.--Sample MGS-M 548, Ste. Genevieve Co., Mo.

Genus POLYGNATHUS Hinde

Hinde's description:

I propose this genus for an animal possessing numerous and variously formed Conodont teeth and similarly minute tuberculated plates grouped together, but of which the natural arrangement is not at present known.

Ulrich and Bassler redefined Polygnathus in 1926.

Ulrich and Bassler's description:

Plate symmetrically lanceolate, traversed by a high median carina extending stalklike from the broader end and reaching, although diminishing gradually in height, to the opposite pointed end, dividing the plate into two lateral, subequal areas. The carina is also indicated by a corresponding ridge on the under side. On the upper surface the summit of the carina carries a row of closely approximated nodes and the depressed sides of the plate are variously ornamented with nodose ridges. The under side is smooth or with fine concentric lines.

Genotype.--Polygnathus dubia Hinde.

Polygnathus aperta Smoot, n. sp.

Plate 2, Figure 16

Plate lanceolate, arched longitudinally. The posterior end is blunt, expanding rather rapidly anteriorly then narrowing rapidly to the blade. A smooth, low carina bisects the plate. Oral surface of plate smooth, concave from the margins inward, gently flexed near the anterior end. Pit located in anterior third of plate, of small size. Keel marking the position of the carina on the

aboral side, slightly higher on the anterior end. Aboral surface of plate smooth.

Holotype.--Univ. of Missouri, C961-3.

Occurrence.--Samples MGS-M 542, 544, 548, Ste. Genevieve Co., Mo.

Remarks.--This seems to be the same form which was described by Quigley (1942) as Polygnathus levis Quigley.

Polygnathus brevilamina

Plate 2, Figure 13

Polygnathus brevilamina Branson and Mehl, 1933, Univ. of Missouri Studies, vol. 8, no. 3, p. 246, pl. 21, figs. 3, 4, 5, 6.

Branson and Mehl's description:

The plate is only about one-third the length of the tooth and the blade is the largest part of the unit. The sides of the plate are separated by the carina, are narrow, little or no wider than the blade, and the margins are slightly serrate. The carina extends back of the plate, where it is made up of several denticles; in front of the plate the blade is high and made up of distinct denticles. The aboral side is sharp on the blade, is a 45 degree ridge on the plate part, and becomes knife-blade-like behind the plate. The pit is narrow and is near the back of the blade. The keel is low excepting near the back end. The description covers a well marked group which grades into forms with the carina extending little in front of the plate and the plate correspondingly longer and wider. The forms with the short plate represent the widest departure from other species.

Holotype.--Univ. of Missouri, C963-2.

Occurrence.--Sample MGS-M 548, Ste. Genevieve Co.,
Mo.

Polygnathus foliata Bryant

Plate 2, Figure 19

Polygnathus foliatus Bryant, 1921, Bull. Buffalo Soc. Nat.
Sci., vol. 13, p. 24, pl. 10, figs. 13-16.
Polygnathus foliata Bryant, Huddle, 1934, Bull. Am.
Paleontology, vol. 21, no. 72, p. 99, pl. 8, figs.
14-17.

Bryant's description:

Dental plate narrowly lanceolate, its margin curled upward like a slightly withered leaf. In profile the plate is sigmoidal in outline, while viewed from above there is a longitudinal medial furrow, from which arises a slender, crenulated keel. This keel extends beyond the main plate as an expanded process, armed above with a few serrations. The upper surface of the main plate is covered with minute tubercles.

Hypotype--Univ. of Missouri, C961-2.

Occurrence--Sample MGS-M 542, Ste. Genevieve
Co., Mo.

Polygnathus munita Smoot, n. sp.

Plate 2, Figure 23

Plate broadly lanceolate, slightly arched longitudinally. Oral surface bearing low ridges which extend from the carina to the lateral margins, becoming lower as they approach the margins. Carina consisting of an irregular ridge which is flexed toward the margin, this margin having somewhat less convexity than the other.

About one-third the length of the plate from the posterior end a lateral ridge extends from the carina toward the less convex margin, having about the same height as the carina. Aboral surface smooth, with faint growth lines concentrically arranged about a small pit. The keel is thin, and extends to the posterior end of the plate. There is no marking on the aboral side corresponding to the lateral ridge of the oral side.

Holotype.--Univ. of Missouri, C961-4.

Occurrence.--Sample MGS-M 548, Ste. Genevieve Co., Mo.

Remarks.--This seems to be the same form which was described by Quigley (1942) as Polygnathus prominens Quigley, from the Sylamore sandstone in Barry Co., Missouri.

Polygnathus nodocostata Branson and Mehl

Plate 2, Figure 20

Polygnathus nodocostata Branson and Mehl, 1933, Univ. of Missouri Studies, vol. 8, no. 3, pp. 246-247, pl. 20, figs. 9, 10, 11, 12, 13, pl. 21, fig. 15.

Branson and Mehl's description:

Plate rhomboidal to elliptical in outline, gently convex, ornamented with five to nine longitudinal rows of small tubercles (sixteen to eighteen in a distance of a millimeter), the middle row being the carina. In some specimens the tubercles coalesce to form ridges. The carina is straight and is made up of tubercles of the same size as those in the other rows, excepting the anterior four or five, which rise into a blade that projects very little in front of the plate.

Hypotype.--Univ. of Missouri, C961-5.

Occurrence.--Samples MGS-M 542, 548, Ste.

Genevieve Co., Mo.

Polygnathus siphonata Smoot, n. sp.

Plate 2, Figure 18

Plate narrow in proportion to length, arched longitudinally, curved laterally. At the anterior end the margins of the plate come together and are upturned to form a siphon-like structure. Posterior to this structure the margins are somewhat upturned, curve outward, then curve inward to the carina at the pointed posterior end. In the middle third of the plate, the margins bear transverse ridges which do not extend to the carina. Posteriorly these become somewhat node-like. Carina low, composed of nodes fused to form an irregular ridge. On the aboral side, a narrow keel arises at the posterior end of the plate, splits to form a small pit located under the siphon, and continues forward onto the blade.

Holotype.--Univ. of Missouri, C962-1.

Occurrence.--Samples MGS-M 541, 542, 543, 544, 548, Ste. Genevieve Co., Mo.

Remarks.--This species seems to be the same as that described by Woods (1955) as Polygnathus siphona Woods.

Polygnathus varinodosa Branson and Mehl

Plate 2, Figures 17, 21

Polygnathus varinodosa Branson and Mehl, 1933, Univ. of Missouri Studies, vol. 8, no. 3, p. 249, pl. 20, fig. 15; pl. 21, figs. 9, 11, 12, 18.

Branson and Mehl's description:

Plate thick, ovate-acuminate in outline, the apex slightly twisted and turned to one side. At the front there is a small notch at one side of the blade. The carina is very small at the apex, becomes broader and higher forward, thence lower and narrower, and thence increases in height to form a short blade. The carina may be irregularly nodose from end to end or the nodes may coalesce so as to be indistinct in part of it. The oral side of the plate bears many nodes of various shapes, sizes, and arrangements in different specimens or in the same specimen. The nodes may be in irregular longitudinal rows or coalesce from row to row and form cross ridges. Some nodes are nearly circular and others are markedly irregular. On the aboral side the keel is high at both ends and low in the middle. The pit is narrow and shallow. The flanks to the plate are convex transversely.

Hypotype.--Univ. of Missouri, C962-2.

Occurrence.--Samples MGS-M 542, 544, Ste.

Genevieve Co., Mo.

Polygnathus sp.

(Not Figured)

Plate narrow, curved laterally, nearly three times as long as wide. Margins subparallel, tapering gradually toward the carina at the anterior end, with sharp pointed posterior end, gentle curve in middle third

of plate. Margins of plate turned up to level of carina, marked by about fourteen transverse ridges, forming a deep median concavity. Carina composed of small fused nodes, forming a fairly smooth ridge. Keel sharp, narrow, widening in the anterior third of the plate to form a small pit. A narrow groove continues onto the blade from the pit.

Specimen.--Univ. of Missouri, C962-3.

Occurrence.--Sample MGS-M 544, Ste. Genevieve Co., Mo.

Family GNATHODIDAE Branson and Mehl

Genus ICRIODUS Branson and Mehl

Branson and Mehl's description:

Platform-like teeth with high sides either straight or flaring near the lower margin, of more or less spindle-shaped or lachrymiform outline in superior view and without a distinct anterior blade as in the polygnathids. The aboral side is deeply excavated its entire length and the oral surface consists of two or more longitudinal rows of low, sharp, cusps.

Genotype.--Icriodus expansus Branson and Mehl.

Icriodus alternatus Branson and Mehl

Plate 2, Figure 2

Icriodus alternatus Branson and Mehl, 1933, Univ. of Missouri Studies, vol. 8, no. 3, pp. 225-226, pl. 13, figs. 4, 5, 6.

Branson and Mehl's description:

Oral platform about four times as long as wide, rounded posteriorly, with sides tapering to an anterior sharp point. About six denticles in each lateral row, all isolated, of conspicuous height, somewhat ridge-like with a slight diagonal trend back from the median line. Denticles of the median row about five, small, rounded, isolated, and alternating with the lateral denticles in position. Sides somewhat higher than width of tooth, sloping outward fairly regularly, with moderate flare toward and around the posterior end. Aboral excavation lachrymiform, extending the entire length of tooth with width gradually diminished to the anterior end.

Hypotype.--Univ. of Missouri, C962-4.

Occurrence.--Samples MGS-M 541, 542, 544, 545, 548, Ste. Genevieve Co., Mo.

Icriodus symmetricus Branson and Mehl

Plate 2, Figure 3

Icriodus symmetricus Branson and Mehl, 1933, Univ. of Missouri Studies, vol. 8, no. 3, p. 226, pl. 13, figs. 1-3.

Branson and Mehl's description:

Oral platform about or slightly more than four times as long as wide, with parallel sides except for the gradual tapering of the anterior part to a sharp end and a less sharply tapered posterior end. Denticles of each lateral row about seven, pointed, subcircular, isolated. Denticles of median row, about eleven, somewhat laterally compressed and more or less connected antero-posteriorly into a straight, sharply nodose, median crest that is somewhat higher than the lateral rows and extends posteriorly about two denticles back of the lateral series. Sides of tooth nearly perpendicular in their anterior half and very broadly and sharply flared in the posterior

part and about the posterior end, with one side usually much more conspicuously flared than the other. Aboral excavation narrow in the anterior half but expanding rapidly behind this into a subcircular outline.

Hypotype.--Univ. of Missouri, C962-5.

Occurrence. Samples MGS-M 541, 548, Ste.

Genevieve Co., Mo.

Icriodus sp. A

Plate 2, Figure 1

Plate thick, straight laterally, with sides nearly parallel. Denticles of each lateral row large, low, fusing transversely to denticles of median row. Sides about as high as width of tooth. Aboral excavation, lachrymiform, width sharply diminished just anterior to third lateral denticles from posterior end. Anterior end unknown.

Figured specimen.--Univ. of Missouri, C963-1.

Occurrence.--Samples MGS-M 544, 548, Ste.

Genevieve Co., Mo.

EXPLANATION OF PLATE 1

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