HOLTS SUMMIT (DEVONIAN) CONODONTS FROM MISSOURI

A Thesis

Presented to

The Faculty of the Graduate School

University of Missouri

In Partial Fulfillment

of the Requirements for the Degree

Master of Arts

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by

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The undersigned, appointed by the Dean of the Graduate Faculty, have examined a thesis entitled

Holts Summit (Devonian) Conodonts
from Missouri

presented by Donald W. Zalusky, A.B.

a candidate for the degree of Master of Arts

and hereby certify that in their opinion it is worthy of acceptance.

Maurice G. Mehl 4/17/58
Clayton H. Johnson 4/17/58
Albert A. Hemphill 4/23/58

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ABSTRACT

The conodonts of a previously unrecognized Upper Devonian formation, the Holts Summit, are unusually abundant and include unique forms which have not been elsewhere reported from strata of North America.

An assemblage from Germany as described by Sannemann is closely allied to the fauna of the Holts Summit.

The Devonian fauna and the stratigraphic relationships exclude the Holts Summit from the Bushberg and "Basal Mississippian" of previous authors.

Lack of recognition in the past of the Holts Summit as a unit has led to the inclusion of its fauna in other faunal lists preventing correlation with these units in this report on the basis of the fauna.

The highly plastic state of development of the fauna is discussed and three new genera are recognized. A partial faunal list is submitted which will enable recognition of the Holts Summit fauna and permit correlation with this unit.

INTRODUCTION

This report presents the results of a study of a Devonian conodont fauna from a formation in Missouri, here recognized as new.

Investigation of a sandstone-shale sequence in the area near Holts Summit, Callaway County, Missouri, by Mehl and others during the fall of 1955, disclosed the presence of an unusually abundant conodont fauna. This fauna contains a number of unique forms, some of which have not been recognized previously in the Devonian of North America. The fauna does not permit close correlation with any previously described biostratigraphic unit of North America, but rather is more closely allied to the conodonts of the Breitengrund bei Bernstein (Stufe II alpha, Oberdevon of Germany) described by Sannemann (1955, p. 123). The general make-up, certain unique forms, and the phylogenetic trends indicate at least a partial time equivalency of the two faunas.

In the course of the work the author has investigated several localities in Callaway County where the sandstone-shale sequence is exposed; and, although outcrops are limited, the sequence has sufficient extent to justify a designation of formational rank. The name Holts Summit is utilized for the sandstone-shale strata in the present report. The unit so designated is described and

stratigraphic relationships are discussed in later pages of this report.

Mehl, under the auspices of the Missouri Geological Survey, has studied this sequence, ranks it as a formation, and has proposed the name Holts Summit for this unit in an unpublished report to the Survey (1958).

PROCEDURES

Field Work: The samples used in the preparation of this report were collected by the author during the fall of 1957.

The objective of the field work was two-fold.

1. To provide conodont material from widely separated sections to insure preparation of a representative faunal list.
2. To discover the areal extent and stratigraphic relationships of the Holts Summit.

In conjunction with the former, samples were carefully taken from each member of the Holts Summit at each collecting locality. These samples were processed individually for a concurrent study of the vertical distribution of the conodonts.

Laboratory procedure: The preparation of samples was in accordance with the technique as suggested by Branson and Mehl (1933, pp. 11-14) and is briefly summarized as follows. The material was reduced in size by the use of a laboratory-model jaw-crusher set for a maximum jaw opening of approximately one-quarter inch. The reduced material was placed in two-quart, enameled sauce pans in a 10% solution of acetic acid to dissolve the calcareous cement. Agitation of the sample was accomplished by gentle boiling over an open flame which increased the effectiveness

of the acid and expedited release of the clay particles. Samples were periodically flushed with clear water to remove the finer particles and the cleaned samples then dried. The dried samples were screened and the minus twenty to plus eighty fractions were heavied with tetrabromoethane, adjusted to a specific gravity of about 2.8, to segregate the quartz and other light minerals from the conodonts and heavy minerals present. The "heavies" were washed with acetone to remove the tetrabromoethane and examined under a stereoscopic microscope. Conodonts were removed with a small, moistened camels-hair brush.

Disposition of specimens: The specimens have been placed in the University of Missouri conodont collection. All specimens were deposited under locality designation, those selected for types and illustration being given additional numbers preceded by the letter C., which is the symbol for conodonts in the University's collections.

PREVIOUS WORK

The strata herein designated the Holts Summit have received very little attention in the literature.

McCarthy (1951, p. 45) figured a measured section (SW ¼, SE ¼, Sec. 22, T. 45 N., R. 11 W., Callaway County) and designated as Bushberg that portion of the section between the Callaway and the Chouteau. The Holts Summit overlies the Callaway at the above locality and was not distinguished from the Bushberg by McCarthy.

Haller (1957, p. 10) placed the Grassy Creek in his undifferentiated "Sulphur Springs" group (Grassy Creek?, Glen Park) and designated as the standard reference section for this group in central Missouri an exposure on Skunk Creek (SE ¼, SE ¼, Sec. 14, T. 45 N., R. 11 W., Callaway County). This section corresponds to my measured section, Figure 1, in which Haller's beds 3 through 5 are designated Holts Summit. Other sections in which the Holts Summit was erroneously designated as Sulphur Springs are Haller's columnar sections 7, 42, and 52. His section 37 on Fitzhugh Creek was not examined by me, but the description of the lithology and stratigraphic relationships lead me to conclude that Haller's Sulphur Springs is the Holts Summit.

Mehl (1958, p. 17) in discussing the Holts Summit states:

In 1933 Branson and Mehl described an exposure of this sandstone from near Dixie, Missouri (NE ¼, NE ¼, Sec. 35, T. 46 N., R. 10 W.). Although misinterpreting some of its relationships they recognized a late Devonian conodont fauna in the sandstone and designated the fauna as Grassy Creek.

The Grassy Creek faunal picture is further confused as the Saverton was not distinguished from the Grassy Creek by Branson and Mehl in their 1933 publication and most of their specimens designated as Grassy Creek (except those from the Holts Summit) come from the Saverton.[1] The Saverton overlies the Grassy Creek and therefore the fauna has an aspect younger than that of the Grassy Creek is presumed to possess. It is apparent that valid Grassy Creek and Saverton faunas must be isolated and described in order to facilitate correlation with these units. Although the faunas of the Grassy Creek and the Saverton were described by Niewoehner (1955) the faunas were again confused because of a failure to recognize the boundaries of these units. However, the faunal lists of the Grassy Creek and the Saverton prepared by Niewoehner are included on the distribution chart of this report and are indicative of the close time relationships of these faunas and that of the Holts Summit. The genus Scutula Sannemann, and Genus "A", Genus "B", and Genus "C" of this study are unreported by Niewoehner, the significance of

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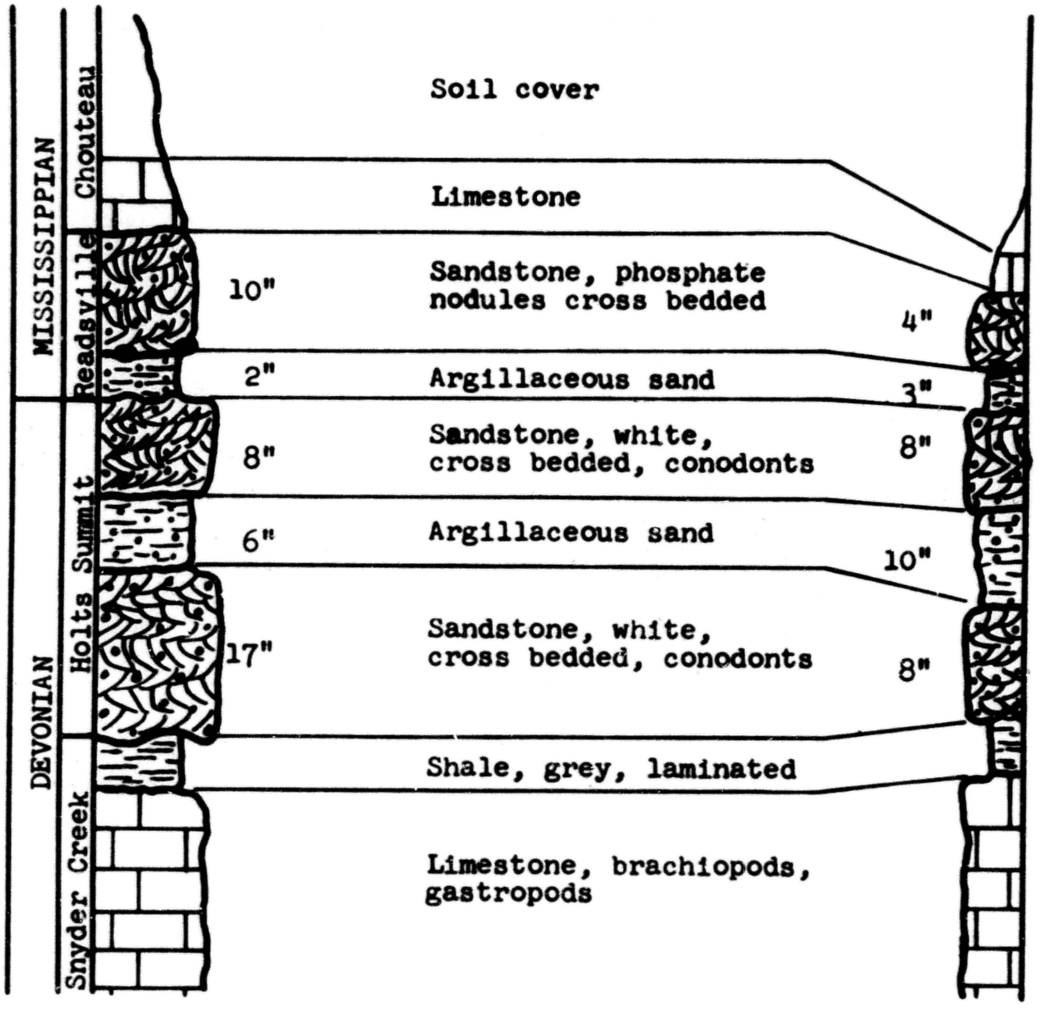
[1]Mehl, personal communication.

which is discussed in later pages. Nevertheless the possibility that the Holts Summit is a time equivalent of the Grassy Creek or of the Saverton cannot be overlooked.



NE ¼, SE ¼, SE ¼, Sec. 11, T. 45 W., R. 11 N.

SE ¼, SW ¼, SE ¼, Sec. 14, T. 45 W., R. 11 N.

MEASURED SECTIONS

of the

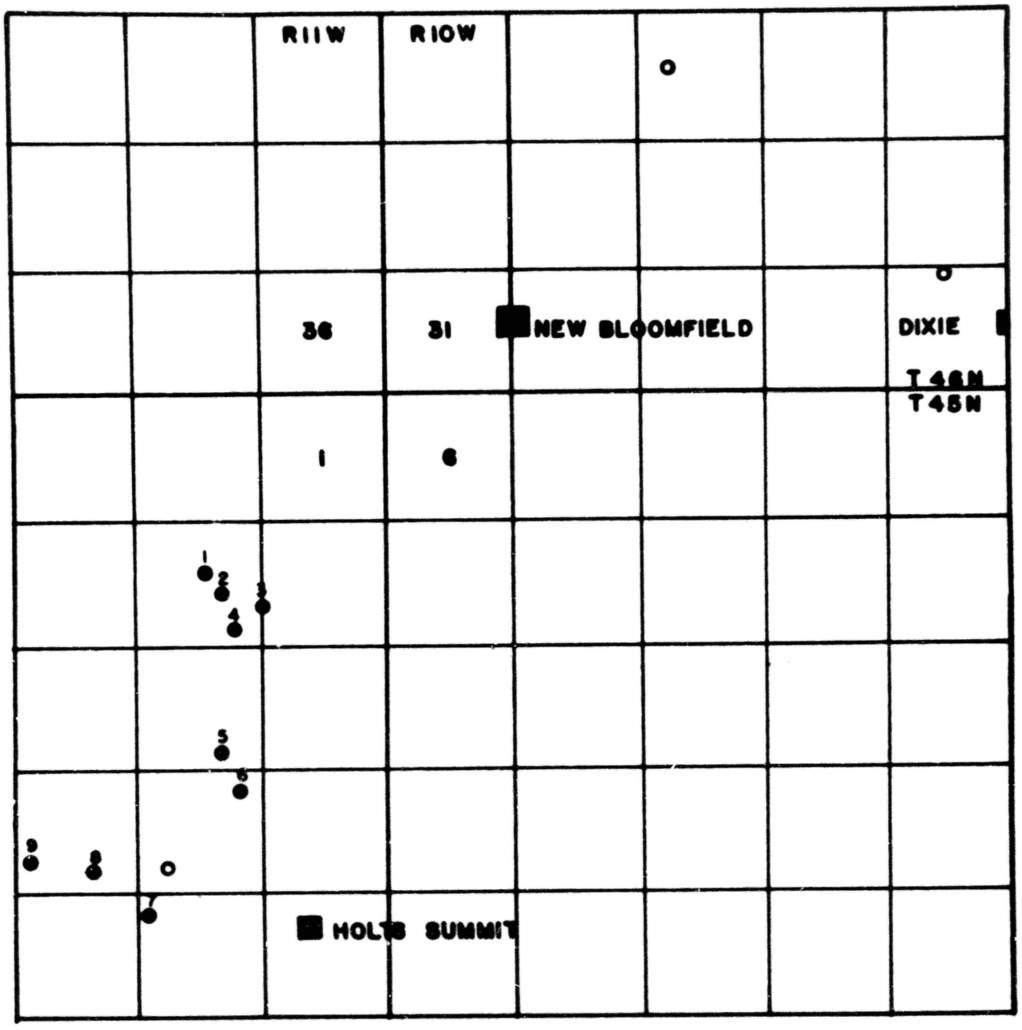
HOLTS SUMMIT

Fig. 1

STRATIGRAPHY

Relationships: The Holts Summit unconformably overlies the Snyder Creek shale at all known exposures except the locality labeled number 9 on Figure 2. Here the underlying formation is identified as the Callaway limestone. The contact between the Holts Summit and the Snyder Creek is marked by the irregular upper surface of a five to ten inch band of shale at the top of the Snyder Creek. Beneath the shale band a variable thickness of a limestone facies of the Snyder Creek overlies the Callaway. Brachiopods are abundant on some bedding planes of the Snyder Creek, and low spired gastropods are present in lesser numbers.

An argillaceous sand, lithologically similar to the middle member of the Holts Summit, overlies the Holts Summit. This is followed by a sandstone bed which is lithologically similar to the upper and lower sandstone members of the Holts Summit. The similarity of the lithology and general appearance might lead to the assumption that this entire sequence represents one stratigraphic unit. Such is not true as is proven by the occurrence of a channel fill (NW ¼, SW ¼, SW ¼, Sec. 12, T. 46 N., R. 11 W.) which truncates beds of the Holts Summit, whereas the uppermost argillaceous sand and



KNOWN EXPOSURES
AND
COLLECTING LOCALITIES
OF THE
HOLTS SUMMIT

○ KNOWN EXPOSURE

● KNOWN EXPOSURE AND COLLECTING LOCALITY

FIG 2

sandstone beds continue uninterrupted over the fill (see photograph, Figure 3).

The overlying argillaceous sand and sandstone beds represent the "Basal Mississippian" of Haller (1957, p. 12) and the "Bushberg" of McCarthy (1951, p. 43). The use of the term Bushberg in this area is challenged by Mehl, and these overlying beds are designated by him as the Readsville (Mehl, 1958, pp. 17-18). The Readsville in this area does not contain an indigenous fauna, but does contain weathered fragments of conodonts reworked from the Holts Summit. The sandstone here is thought to be late Kinderhook in age.

A thin layer of a blue-gray limestone, the Chouteau, overlies the Readsville and is separated with difficulty from the Readsville in unweathered portions of the section. In some localities within this area the Burlington limestone overlies the Chouteau, but in others the Chouteau is the youngest rock present.

Distribution: The geographical extent of the Holts Summit is unknown but seems to be limited to the southwestern part of Callaway County. The type locality designated by Mehl (1958, p. 18) is located in the SW ¼, NW ¼, SW ¼, Sec. 12, T. 45 N., R. 11 W., Callaway County. Localities of the known exposures are shown on Figure 2.

Lithology: The Holts Summit at the type locality consists of beds in ascending order as follows:

1. A lower sandstone, consisting of fairly uniform size quartz grains with conspicuous crystal regrowth, moderately to well cemented with calcareous cement; white on fresh surfaces, brown, "case hardened" on weathered surfaces. The lower surface is irregular and thickness ranges from six to seventeen inches. Conodonts are displayed as black streaks on cross-bedding planes. Mud cracks and worm burrowings are common.
2. A middle highly argillaceous sand, consisting of fairly uniform size quartz grains in a matrix of clay particles which give the bed its color. The color is more or less banded as blue-green, white and brown streaks. The bed weathers like shale and forms a reentrant between the upper and lower sandstones. The thickness ranges from six to eleven inches. Conodonts are present in considerably lesser numbers than in either of the two sandstone members.
3. An upper sandstone, consisting of fairly uniform size quartz grains with conspicuous crystal regrowth, moderately to well cemented with calcareous cement; white on fresh surfaces, brown, "case

hardened" on weathered surfaces. The upper surface is slightly irregular and the bed possesses a fairly uniform thickness of six to eight inches. Conodonts are displayed as black streaks on cross-bedding planes, and, rarely, a linguloid brachiopod may be found.

FIGURE 3

New Bloomfield Channel Fill
Truncating Beds
of the
Holts Summit

1. Beds of the Holts Summit.
2. Beds of the Snyder Creek.
3. Ditch exposing the Readsville which is continuous over the channel fill.

NATURE OF THE CONODONT FAUNA

Conodonts are present in such great numbers in the sandstone members of the Holts Summit that they must be considered as constituting a moderate portion of the rock. Dark lines seen along the bedding planes suggest a concentration of dark colored mineral grains, but upon closer examination are found to be conodonts. Details of the cross bedding might be unnoticed in casual observation but for the conodonts which are concentrated on the bedding planes.

An unusually high ratio of whole conodonts to broken specimens were recovered, suggesting that the conodonts were transported relatively short distances.

This remarkable assemblage holds high promise for the clarification of several of the problems concerning conodonts. One worker, Perry, (1957) utilized material from these beds to demonstrate the diversity of form in the ontogenetic stages, thereby illustrating the possibility of naming two or more species from different growth stages of a single species. A statistical analysis of the fauna is currently being conducted by Ellis[1] and upwards of twenty thousand conodonts will form the base of the statistical data available for interpretation.

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[1]Doctoral candidate, Univ. of Missouri, Graduate School.

Several thousand specimens were available to the author from a comparatively small number of samples and it became necessary to limit the scope of the problem to the preparation of a partial, but representative, faunal list. The time available would not permit a complete analysis of the less well represented forms.

The analysis of the samples for vertical distribution did not disclose any apparent "zones"; however an exhaustive examination was not made for this purpose.

A total of eighty-seven species was chosen for description and photography. This included representatives of twenty-one known genera and some forms which apparently are not included in described genera. The latter forms constitute three morphological types and are referred to as Genus "A", Genus "B", and Genus "C".

Representatives of the genus Palmatolepis predominate, constituting 49.9% of the total number of specimens.[1] Twelve species of the genus are identified, one of which, P. distorta, could be cited as the dominant form of the fauna as it includes about half of the palmatolepid specimens.

The species of Polygnathus are numerous, twenty-two, and the variations among individuals tend to make specific determinations difficult. Polygnathids vary from the

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[1]Ellis, personal communication.

"typical" forms, such as P. triangularis, to those forms (Ctenopolygnathus) which have been segregated from the polygnathids by Muller and Muller (1957, p. 1084). Included in the latter group from this fauna are P. angustidiscus and P. brevipennata, whereas P. caelatus is intermediate between those forms with the plate extended to the posterior margin and the proposed genus **Ctenopolygnathus**.

The polylophodontids, while not abundant, are perhaps more varied in this fauna than is usual. There are five species represented, one of which is new. Specimens possessing generic characteristics of both Polylophodonta and Polygnathus bridge the gap between these two genera.

Ancyrodellids and ancyrognathids are uncommon and small in size. The ancyrodellids show very little tendency toward the development of tertiary keels as to those of the "Passo Beds", described by Johnson (1957).

The anteriorly bi-limbed forms are present in greater numbers than is usual in the late Devonian faunas, and a complete gradation through the series, Diplodella, Hibbardella, Trichonodella, is demonstrated in the Holts Summit fauna. The position of the minor denticles with respect to the major denticles of the limbs constitutes the primary generic difference between the genus Diplodella

and the genus Hibberdella; however, specimens of this fauna display complete gradation from forms possessing two or even three rows of subequal denticles to forms in which the major or minor denticles originate from the same plane. The size of the aboral pit as a distinguishing characteristic between the genus Hibbardella and the genus Trichonodella is ineffective as specimens of the Holts Summit possess pits ranging in size from a slight groove to the broad aboral excavation of the trichonodellids. The intermediate forms are given a generic designation with difficulty.

The bryantodids and nothognathellids are fairly common, well preserved, varied, and some are difficult to distinguish from one another.

Spathognathodids are common and varied. Six species of Spathognathodus are identified, three of which are new. One specimen of S. regularis was recovered. This species is otherwise unknown outside the Mississippian period but the presence of one individual does not suggest a stratigraphic leak. The specimen is rather small but perfectly preserved, and may represent the juvenile form of another species.

The genus Prioniodus is represented by five species, two of which are new. The variation within the prioniodids possessing denticulation on the anterior oral edge of the

anticusp is considerable, and these prioniodids are distinguished with difficulty from the genus Synprioniodina.

Representatives of the genus Scutula, described from German strata in 1955, (Sannemann, p. 154) were not previously known to be present on the North American continent but are identified in the Holts Summit fauna. There are few representatives but because of the small size it is not known if they are rare in the Holts Summit or if they are lost as a result of the recovery methods used.

The most prevalent bar forms in the fauna are members of the genus Lonchodina; however, few complete specimens are recovered. Four species are identified.

The ligonodinid, hindeodellid, and centrognathodid specimens although fragmented are in general better preserved than is usual. Several different types of centrognathodids are recognized to be present although too badly fragmented for specific identification. The acidizing technique may be utilized to recover complete specimens of these genera.

Specimens of the genus Ozarkodina are numerous and three species are identified. The ozarkodinids display much diversity of form, and it is difficult to determine

if the generic affiliation of some specimens is Bryantodus or Ozarkodina. The very thin bladed types, referred to the genus Ctenognathus by Stauffer, are present in equal numbers with the thicker bladed forms. The primary difference other than the thickness, seems to be the height to which the denticles are sheathed, the thinner type being sheathed almost to the apices.

One species of Icriodus, I. planus is identified for the first time on the North American continent. This species was identified from the German Breitengrund and incorrectly referred to the genus Pelekysgnathus by Sannemann (1955, p. 149). The genus Pelekysgnathus was proposed by Thomas (1949, p. 424) to include several species found in the Maple Mill shale. This genus differs from the genus Icriodus in that the oral edge is restricted to one row of denticles rather than two or three. I believe the affiliation should be Icriodus and the generic description should be modified to include these forms, the distinction being specific rather than generic.

Representatives of the genus Angulodus are rare and only two species are identified.

Although but one prioniodinid is figured, numerous fragments indicate that several species are present.

The representatives of the three new genera,

Genus "A", Genus "B", and Genus "C", although rare, are important elements of the fauna because they are unknown from other strata.

AGE AND CORRELATION OF THE HOLTS SUMMIT

For reasons cited on previous pages it is impossible to correlate the Holts Summit with units on the North American continent. However, when a valid conodont fauna is isolated from the Grassy Creek and from the Saverton, the Holts Summit may be found to be contemporaneous with one of these units. The close faunal relationships of the Holts Summit and the Grassy Creek and the Saverton is demonstrated on the distribution chart, Table 1. The significance of the number of congeneric species must not be the deciding factor. The differences, exemplified by the appearance of new forms unrecorded in older rocks, indicate changes generally associated with progressive evolution which suggest a younger fauna.

The correlation with biostratigraphic zones in Europe must be approached with caution, as mere number of species in common will perhaps be an ineffective guide, particularly as the Holts Summit fauna is in a highly plastic stage of development. The suggested criterion is a study of the short ranging species and, if present, the unusual or new forms held in common.

The Holts Summit fauna includes three new genera, one of which is represented in the Breitengrund fauna by a specimen figured by Sannemann (1955, pl. 6, fig. 5) as

Ozarkodina regularis. I believe this specimen is incorrectly identified and have placed it in Genus "C" in this report.

The Breitengrund fauna also contains Icriodus planus, previously unreported elsewhere, but present in the Holts Summit fauna.

The Palmatolepis suite is more varied in the Holts Summit than in the Breitengrund and transcends the zones (see Figure 4) erected by Sannemann (1955, p. 326); however, in general it reflects the character of the Breitengrund suite.

The Holts Summit is believed by the author to be at least a partial time equivalent of the Breitengrund, which is assigned to Stufe II alpha of the Oberdevon of Germany.

It is expected that closer correlation on the North American continent will be possible concurrent with isolation and description of the faunas of the Grassy Creek and Saverton shales.

Figure 4

Ranges of Oberdevon Conodonts of Germany

(After Sannemann)

SUMMARY AND CONCLUSIONS

The conodonts of a previously unrecognized Upper Devonian formation, the Holts Summit, are unusually abundant and include unique forms. A review of the literature shows that faunas possessing these unique elements have not been recognized in the strata of the North American continent.

An assemblage described by Sannemann from the strata of the Breitengrund bei Berstein (Stufe II alpha, Oberdevon of Germany) is closely allied to the fauna of the Holts Summit.

The Devonian fauna and stratigraphic relationships exclude the Holts Summit from the Bushberg and "Basal Mississippian" of previous authors.

The lack of recognition of the Holts Summit as a unit has led to the inclusion of its fauna in the faunal list of the Grassy Creek. Therefore, correlation with this unit is impossible until a valid Grassy Creek fauna is described. The validity of the Saverton faunal list is also in doubt and requires clarification.

The highly plastic stage of evolution of the Holts Summit fauna is evidenced by almost complete gradation between some genera, and the presence of some forms not previously recognized in older rocks.

Three new genera are recognized and a partial faunal

list is submitted which will enable recognition of the Holts Summit fauna and permit correlation with this unit.

The three new genera and the genus Scutula are considered of prime importance as definitive time markers, and it is suggested that correlation based on numbers in common of long ranging species be applied with caution.

Conclusions based on these observations can be stated as follows:

1. The Holts Summit is a formation and not part of a previously designated unit.
2. The Holts Summit cannot be correlated at the present time with units of North America on the basis of its fauna.
3. The faunas of the Grassy Creek and the Saverton must be redescribed.
4. The Holts Summit is at least a partial time equivalent of the Breitengrund bei Bernstein assigned to the Stufe II alpha zone of the Oberdevon of Germany.

TABLE I

DISTRIBUTION CHART OF THE CONODONT GENERA AND SPECIES IDENTIFIED

Holts Summit	1	2	3	4	5	Holts Summit	1	2	3	4	5
Ancyrodella lobata ?	x	x				Polygnathus angustidiscus					
Ancyrodella nodosa						Polygnathus brevilamina	x	x	x	x	
Ancyrodella robusta						Polygnathus caelatus					
Ancyrodella woodsi						Polygnathus communis					
Ancyrognathus irregularis	x	x				Polygnathus granulosa	x	x			
Ancyrognathus symmetrica	x	x				Polygnathus gravis					
Angulodus bidentatus			x			Polygnathus grossus					
Angulodus demissus						Polygnathus inconditus					
Bryantodus (?) commutatus						Polygnathus inelegans					
Bryantodus dignatus						Polygnathus largus					
Bryantodus mundus		x				Polygnathus latus					
Bryantodus nitidus			x			Polygnathus nodocostata	x	x			
Bryantodus winchelli						Polygnathus psuedocommunis					
Diplodella alternata	x	x				Polygnathus cf rhombodia					
Hibbardella plana						Polygnathus sanduskiensis					
Hindeodella brevis		x				Polygnathus semicostata	x	x			
Hindeodella subtilis						Polygnathus sinelamina ?	x	x	x		
Icriodus alternatus	x	x				Polygnathus subserrata					
Icriodus curvatus				x		Polygnathus subtrigona					
Icriodus planus			x			Polygnathus triangularis	x	x			
Icriodus symmetricus	x	x				Polygnathus varinodosa	x	x			
Ligonodina delicata						Polylophodonta concentrica	x	x			
Lonchodina brevipennata	x	x				Polylophodonta crassa					
Lonchodina curvidens						Polylophodonta gyralineata	x	x			
Lonchodina pulchra		x				Polylophodonta linguiformis	x	x			
Lonchodina (?) robusta		x				Polylophodonta rugosa	x	x			
Nothognathella condita			x			Prioniodus alternatus					
Nothognathella ornata						Prioniodus dolebriformis					
Nothognathella reversa	x	x				Prioniodus molestus			x		
Nothognathella typicalis		x				Prioniodus obtusus					
*Ozarkodina arcuata			x	x	x	Prioniodus tortus		x			
Ozarkodina elegans			x			Scutula venusta			x		
Ozarkodina falsiformis						Spathognathodus acutus					
Palmatolepis distorta	x	x		x	x	Spathognathodus alveolus					
Palmatolepis elongata						Spathognathodus amplus					
Palmatolepis flabelliformis						Spathognathodus longus					
Palmatolepis glabra	x	x	x	x	x	Spathognathodus regularis					
*Palmatolepis gracilis				x	x	Spathognathodus strigosus	x	x			
Palmatolepis minuta		x	x	x		Trichonodella robusta	x	x			
Palmatolepis planulata						Trichonodella subincilis					
Palmatolepis perlobata	x	x	x	x	x	Trichonodella torta					
Palmatolepis quadrantinodosa	x	x		x	x	Trichonodella tumida	x	x			
Palmatolepis rugosa						Genus "A" sp. A					
Palmatolepis subperlobata	x	x	x			Genus "B" sp. A					
Palmatolepis undosa						Genus "C" sp. A			x		
Polygnathus alveus											

*Identified by Branson and Mehl from the Dixie locality.

1. Grassy Creek, reported by Niewoehner.
2. Saverton, reported by Niewoehner.
3. II alpha, Germany, reported by Sannemann.
4. III alpha, Germany, reported by Bischoff and Ziegler.
5. II alpha - III, Germany, reported by Bischoff and Ziegler.

Columns 4 and 5 shown for comparison with younger German faunal zones.

SYSTEMATIC PALEONTOLOGY

In this report only new forms are described in detail. Original descriptions of known forms are omitted except that attention is called to deviations, if any, from the holotype. In each description the reference to the publication containing the original description is cited.

The order followed in this report is as follows:

(1) Polygnathus subserrata Branson and Mehl
(2) Plate 3, figure 7
(3) 1933, Univ. of Missouri Studies, vol. 8, no. 1, p. 248, pl. 20, figs. 17-19.
(4) Juvenile forms are difficult. . .

Explanation of the above example is as follows:

(1) Generic and trivial names; author or authors credited with original description.
(2) Plate and figure numbers referred to illustrations in this report.
(3) Year of publication, journal in which published, page on which described, and plate and figure or figures illustrating original description.
(4) Deviations, if any, from original description.

As several of the original descriptions are published in German and are not readily available, the description is quoted. A literal translation is included in the appendices for the benefit of those unfamiliar with the German language.

Order CONODONTOPHORIDIA

Suborder CONODONTIFORMES

Family PRIONIOIDAE

Genus ANGULODUS Huddle (1934)

Angulodus bidentatus Sannemann

Pl. 2, Fig. 16

1955, Senckenbergiana Lethaea, band 36, p. 127, Taf. 3, fig. 18.

Diagnose: Eine Art der Gattung Angulodus, die sich durch ein kräftiges Zähnchen auf Vorderast auszeichnet.

Beschreibung: Schlanker Hauptzahn. Hinterast rd 1/3 länger als deiser, dicht besetzt mit nach hinten an Grösse zunehmenden Zähnchen; Bezähnelung am Hinterrand des Hauptzahnes etwas hinaufziehend. Vorderast rd 1/2 so lang wie der Hinterast, aborale Kante mit der Hinterkante des Hauptzahnes eine Linie bilden; besetzt mit schlanken, etwas nach hinten gebogenen Zähnchen, die vom Hauptzahn aus bis zur Mitte an Grösse zunehmen und dann wieder abnehmen. Grösstes Zähnchen rd 2/3 des Hauptzahnes.

Occurrence: Holts Summit

Figured specimen: Univ. of Missouri, C 935-2

Angulodus demissus Huddle

Pl. 2, Fig. 11

1934, Bull. Am. Paleont., vol. 21, no. 72, p. 16, 76-77, pl. 10, fig. 15.

Occurrence: Holts Summit

Figured specimen: Univ. of Missouri, C 935-2

Genus CENTROGNATHODUS Branson and Mehl (1934)

Centrognathodus sp. ind.

Pl. 3, Fig. 9

Unit gently arched, anterior and posterior limbs in the same plane, anterior limb denticles, about four, first three anterior to major denticle short, slightly compressed, sheathed almost to apices, making bar appear very heavy in this region, anterior-most denticle isolated from the remainder, broken on this specimen. Lateral process, anterior to fang, and almost normal to major axis. Posterior bar broken, remaining portion smaller than anterior limb in cross section. Fang slanted posteriorly. Aborally, no pit visible, aboral edges more or less sharp. Edge of lateral process curves anteriorly, anastomoses with longitudinal axis at a small angle.

Occurrence: Holts Summit

Figured specimen: Univ. of Missouri, C 935-3

Centrognathodus sp. ind.

Pl. 3, Fig. 10

The bar, stout, deeper than wide, aboral edge tapered to a more or less sharp edge. Anterior limb down-curved; denticles, about five, first denticle anterior to apical denticle small, remainder large. The

lateral process anterior to apical denticle about equal in length and with similar denticulation as anterior limb. Lateral process down-curved, directed laterally and backwards, making an angle at juncture with anterior limb of about 120 degrees. The posterior limb about half the length of other two limbs, slightly down-curved; denticles about three, angle formed with juncture of lateral limb about 100 degrees. Denticles of all limbs subcircular, peg-like, isolated. Apical denticle originating more on posterior limb than at juncture of the three limbs. Aborally, a small pit beneath the apical denticle, extending a short distance along aboral edge of anterior limb.

Occurrence: Holts Summit

Figured specimen: Univ. of Missouri, C 935-4

Genus DIPLODELLA Ulrich and Bassler (1926)

Diplodella alternata Branson and Mehl

Pl. 3, Fig. 6

1934, Univ. of Missouri Studies, vol. 8, no. 3, p. 204, pl. 16, figs. 23-24.

Occurrence: Holts Summit

Figured specimen: Univ. of Missouri, C 935-5

Diplodella sp. ind.

Pl. 4, Fig. 11

Anterior process thin and deep, in same plane as posterior bar. Inner lateral process denticles, about five in number, subequal and smaller than outer denticles. No alternation of denticles within inner set, major denticles of outer set separated by lesser denticles which originate anterior to major denticles. Slender apical denticle slightly posterior to lateral processes, elongated posteriorly at base. Form of posterior bar unknown.

Occurrence: Holts Summit

Figured specimen: Univ. of Missouri, C 936-1

Genus HIBBARDELLA Ulrich and Bassler (1926)

Hibbardella plana Thomas

Pl. 3, Fig. 16

1949, Geol. Soc. Am., Bull., vol. 60, no. 3, p. 422, pl. 2, fig. 28.

Occurrence: Holts Summit

Figured specimen: Univ. of Missouri, C 936-2

Genus HINDEODELLA Ulrich and Bassler (1926)

Hindeodella brevis Branson and Mehl

Pl. 3, Fig. 1

1934, Univ. of Missouri Studies, vol. 8, no. 3, p. 195, pl. 14, figs. 6-7.

Occurrence: Holts Summit

Figured specimen: Univ. of Missouri, C 936-3

Hindeodella subtilis? Ulrich and Bassler (1926)

Pl. 3, Fig. 3

1926, U. S. Nat. Mus. Proc., vol. 68, art. 12, no. 2613, p. 39, pl. 8, figs. 17-19.

This specimen appears to conform to the specific description except the anterior bar is broken off and the diagnostic characteristic, a nondenticulated portion, is missing on the figured specimen. For this reason the specimen is questionably assigned to this species.

Occurrence: Holts Summit

Figured specimen: Univ. of Missouri, C 936-4

Hindeodella sp. ind.

Pl. 3, Fig. 2

The bar short, curved inwardly anterior to the major denticle, in the same plane as the posterior bar. Posterior limb extremity recurved downward; deeper than wide, rounded shoulders orally, thin, sharp edge aborally. Posterior denticles about ten, increasing in size

posteriorly, laterally compressed, gradually inclined posteriorly, last denticle in horizontal position, alternating with lesser denticles which are circular in cross section. Denticles of anterior limb about fourteen, circular, alternating in size; larger denticles not so large as those of the posterior limb. Small pit on inner lateral margin.

Occurrence: Holts Summit

Figured specimen: Univ. of Missouri, C 936-5

Genus LIGONODINA Ulrich and Bassler (1926)

Ligonodina delicata Branson and Mehl

Pl. 3, Fig. 5

1934, Univ. of Missouri Studies, vol. 8, no. 3, p. 199, pl. 14, figs. 22-23.

Representatives of this species from the Holts Summit differ from the original description in that the anterior-inferior process does not continue the curve of the fang but is directed straight downward at the extremity thus interrupting the symmetry of the curve.

Occurrence: Holts Summit

Figured specimen: Univ. of Missouri, C 937-1

Genus TRICHONODELLA Branson and Mehl

Trichonodella robusta Branson and Mehl

Pl. 3, Fig. 18

1934, Univ. of Missouri Studies, vol. 8, no. 3, p. 203, pl. 15, fig. 31.

Occurrence: Holts Summit

Figured specimen: Univ. of Missouri, C 937-2

Trichonodella subincilis Johnson

Pl. 3, Fig. 11

1957, Unpub. Master's thesis, Univ. of Missouri, Columbia, Missouri, p. 34, pl. 1, figs. 10-11.

Occurrence: Holts Summit

Figured specimen: Univ. of Missouri, C 937-3

Trichonodella torta Zalusky, n. sp.

Pl. 3, Fig. 14

Anterior arch sharply flexed at apex, stout limbs extending downward and twisted inward at a 45 degree angle, spatulate at extremity, aboral edges sharp. Limb denticles in plane of limb, increasing in size outward, about eight in number. Fang, recurved at base, rounded anteriorly, carinae on lateral sides, short sulcus on posterior base. Moderate excavation at apex of arch. Posterior bar, slender, denticulate, of unknown extent.

Occurrence: Holts Summit

Holotype: Univ. of Missouri, C 937-4

Triconodella tumida Branson and Mehl

Pl. 3, Fig. 12

1934, Univ. of Missouri Studies, vol. 8, no. 3, p. 202, pl. 16, fig. 28.

Occurrence: Holts Summit

Figured specimen: Univ. of Missouri, C 937-5

Family PRIONIODINIDAE

Genus BRYANTODUS

Bryantodus commutatus Branson and Mehl

Pl. 4, Fig. 27

1934, Univ. of Missouri Studies, vol. 8, no. 3, pp. 223-224, pl. 16, fig. 15.

Occurrence: Holts Summit

Figured specimen: Univ. of Missouri, C 938-1

Bryantodus dignatus Stauffer

Pl. 2, Fig. 10

1938, Jour. Paleont., vol. 12, no. 5, pp. 412, 420-421, pl. 48, fig. 29.

Occurrence: Holts Summit

Figured specimen: Univ. of Missouri, C 938-2

Bryantodus mundus Branson and Mehl

Pl. 3, Fig. 13

1934, Univ. of Missouri Studies, vol. 8, no. 4, p. 284, pl. 23, fig. 9.

Occurrence: Holts Summit

Figured specimen: Univ. of Missouri, C 938-3

Bryantodus nitidus Ulrich and Bassler

Pl. 2, Fig. 15

1926, U. S. Nat. Mus. Proc., vol. 68, art. 12, no. 2613, p. 24, pl. 4, figs. 12-14.

Occurrence: Holts Summit

Figured specimen: Univ. of Missouri, C 938-4

Bryantodus winchelli Stauffer

Pl. 2, Fig. 5

1938, Jour. Paleont., vol. 12, no. 5, pp. 412, 423, pl. 48, fig. 33.

Occurrence: Holts Summit

Figured specimen: Univ. of Missouri, C 938-5

Genus LONCHODINA Ulrich and Bassler

Lonchodina brevipennata Branson and Mehl

Pl. 2, Fig. 7

1934, Univ. of Missouri Studies, vol. 8, no. 3, p. 212, pl. 15, fig. 13.

Occurrence: Holts Summit

Figured specimen: Univ. of Missouri, C 939-1

Lonchodina curvidens Branson, E. R.

Pl. 3, Fig. 17

1934, Univ. of Missouri Studies, vol. 8, no. 4, p. 330, pl. 28, fig. 14.

Occurrence: Holts Summit

Figured specimen: Univ. of Missouri, C 939-2

Lonchodina pulchra Branson and Mehl

Pl. 2, Fig. 8

1934, Univ. of Missouri Studies, vol. 8, no. 3, p. 211, pl. 15, fig. 16.

Occurrence: Holts Summit

Figured specimen: Univ. of Missouri, C 939-3

Lonchodina(?)robusta Branson and Mehl

Pl. 4, Fig. 25

1934, Univ. of Missouri Studies, vol. 8, no. 3, p. 213, pl. 15, fig. 19.

Occurrence: Holts Summit

Figured specimen: Univ. of Missouri, C 939-4

Genus NOTHOGNATHELLA Branson and Mehl

Nothognathella condita Branson and Mehl

Pl. 2, Fig. 9

1934, Univ. of Missouri Studies, vol. 8, no. 3, p. 230, pl. 13, figs. 25-26.

Occurrence: Holts Summit

Figured specimen: Univ. of Missouri, C 939-5

Nothognathella ornata Zalusky, n. sp.

Pl. 4, Fig. 21

Arch sharp, the limbs about equal, aboral side of anterior limb sharp, aboral surface of posterior limb flattened, inner flange of posterior limb widely flared up to apex, gradually tapering to point anteriorly, formed by junction with outer flange. Outer flange narrow posteriorly, slightly lobed at apex, narrow anteriorly, tapered to a point formed by juncture with inner flange. Anterior limb denticles about eight, stout, laterally compressed, fused almost to apices; posterior denticles, about twelve, offset to outside of plate posterior to large apical denticle, two or three appressed and fused to apex, remainder peg-like. The ornamentation of the flanges, posteriorly, ridged normal to denticles, anteriorly serrate on inner side, faintly serrate on outer side to smooth on anterior half of outerside. The keel, corresponding to denticles, sharp beneath anterior limb, low ridge beneath posterior limb, small elongate pit at apex.

Occurrence: Holts Summit

Holotype: Univ. of Missouri, C 940-1

Nothognathella reversa Branson and Mehl

Pl. 3, Fig. 4

1934, Univ. of Missouri Studies, vol. 8, no. 3, p. 231, pl. 13, figs. 9-10.

Occurrence: Holts Summit

Figured specimen: Univ. of Missouri, C 940-2

Nothognathella typicalis Branson and Mehl

Pl. 4, Fig. 23

1934, Univ. of Missouri Studies, vol. 8, no. 3, p. 227, pl. 13, figs. 7-8.

Occurrence: Holts Summit

Figured specimen: Univ. of Missouri, C 940-3

Genus OZARKODINA Branson and Mehl

Ozarkodina elegans (Stauffer)

Pl. 4, Fig. 26

1938, (Ctenognathus elegans), Jour. Paleont., vol. 12, no. 5, pp. 412, 424-425, pl. 48, figs. 9, 12.

Occurrence: Holts Summit

Figured specimen: Univ. of Missouri, C 940-4

Ozarkodina falsiformis (Stauffer)

Pl. 2, Fig. 1

1938, (Ctenognathus falsiformis), Jour. Paleont., vol. 12, no. 5, pp. 412, 425, pl. 48, figs. 4, 7.

Occurrence: Holts Summit

Figured specimen: Univ. of Missouri, C 940-5

Genus PRIONIODINA Ulrich and Bassler 1926

Prioniodina sp. ind.

Pl. 2, Fig. 13

The bar, short, in lateral view, straight from posterior end to apical dentical, down-curved anterior to this. The denticles broken, slightly compressed, four anterior to the large apical denticle, seven in the posterior series, germ denticles visible in bar, suppressed in region of apical denticle. Apical denticle flattened on one side, rounded on the other. Pit, small, elongate, located beneath apical denticle.

Occurrence: Holts Summit

Figured specimen: Univ. of Missouri, C 941-1

Genus PRIONIODUS Pander

Prioniodus alternatus Zalusky, n. sp.

Pl. 2, Fig. 14

Posterior bar, long, elliptical in cross section posteriorly, thinned to sharp aboral edge anteriorly, slightly bowed inwardly. Denticles, about twenty in major series, equal, peg-like, isolated. Minor denticles alternating with major series, originating at outside lateral edge of major denticles, forming two planes of denticles. Anticusp deflected downward and laterally, aboral edge sharp, anterior extremity pointed. Anticusp denticles, about five, peg-like, about the same size as the major series of the posterior limb. Apical denticle short, circular, slender; small aboral projection on inner base. Apical and other denticles directed orally in same plane.

Occurrence: Holts Summit

Holotype: Univ. of Missouri, C 941-2

Prioniodus dolabriformis Zalusky, n. sp.

Pl. 4, Fig. 17

Pick-shaped unit. The bar short, tapering to a point posteriorly in lateral view; nondenticulate, broadly excavated aborally, excavation continuous anteriorly and downward into posterior margin of anticusp. Cusp, wide at

base, laterally compressed with sharp anterior and posterior edges, gently recurved. Anticusp thin, gently recurved, bowed inwardly, shape of extremity unknown. Anterior edge of cusp and anticusp extremely thin.

Occurrence: Holts Summit

Holotype: Univ. of Missouri, C 941-3

Prioniodus molestus Branson and Mehl

Pl. 2, Fig. 17

1934, Univ. of Missouri Studies, vol. 8, no. 3, p. 207, pl. 15, fig. 8

Occurrence: Holts Summit

Figured specimen: Univ. of Missouri, C 941-4

Prioniodus obtusus Branson and Mehl

Pl. 2, Fig. 2

1934, Univ. of Missouri Studies, vol. 8, no. 3, p. 205, pl. 15, figs. 4-5.

Occurrence: Holts Summit

Figured specimen: Univ. of Missouri, C 941-5

Prioniodus tortus Branson and Mehl

Pl. 3, Fig. 15

1934, Univ. of Missouri Studies, vol. 8, no. 3, p. 208, pl. 15, fig. 3.

Occurrence: Holts Summit

Figured specimen: Univ. of Missouri, C 942-1

Genus SPATHOGNATHODUS Branson and Mehl

Spathognathodus acutus Zalusky, n. sp.

Pl. 2, Fig. 4

The blade, thin, straight in anterior two-thirds, bowed posterior to navel. In lateral view aboral edge straight, high in anterior third, height decreased posterior to last of series of wide denticles, sloping upward again to maximum height over navel, decreasing from this point posteriorly as the oral edge slopes downward to the aboral edge. The denticles about twenty, compressed, fused with short free apices, anterior five or six the largest. Germ denticles quite evident, all continue to oral terminations. The pit located two-thirds of unit length from anterior, subcircular to slightly elongate diagonally, short sulcus extending anteriorly into aboral edge, narrow lateral flanges.

Occurrence: Holts Summit

Holotype: Univ. of Missouri, C 942-2

Spathognathodus alveolus Zalusky, n. sp.

Pl. 2, Fig. 6

The blade short, in oral view, straight; in lateral view, oral edge decreasing in height from anterior to posterior, aboral edge sharply offset upward at pit, continuing to posterior termination as straight line. The

denticles about sixteen, largest in anterior half, laterally compressed, fused below short free apices, germ denticles visible, some supression by lateral fusion near oral edge. Navel located in vertical offset of aboral edge, shallow, elongate, faintly flared, flanges thickened anteriorly, as faint ridges near aboral edge posteriorly.

Occurrence: Holts Summit

Holotype: Univ. of Missouri, C 942-3

Spathognathodus amplus Branson and Mehl

Pl. 2, Fig. 3

1934, Univ. of Missouri Studies, vol. 8, no. 3, p. 190, pl. 17, fig. 9.

Occurrence: Holts Summit

Figured specimen: Univ. of Missouri, C 942-4

Spathognathodus longus Zalusky, n. sp.

Pl. 2, Fig. 19

The blade long, gently bowed in oral view. In lateral view oral edge high and sloping posteriorly in anterior third level in middle, sloping downward in posterior third. Aboral edge straight except for gradual upcurving in anterior quarter, rounded at posterior; leading edge intersects aboral edge at about 75 degrees. The denticles, about twenty-five, laterally compressed, with short free apices for larger anterior and a few posterior denticles, remainder fused to apices with

slightly crenulate oral edge. Pit about mid-length, shallow, elongate anterio-posteriorly, slightly flared thickened flanges.

Occurrence: Holts Summit

Holotype: Univ. of Missouri, C 942-5

Spathognathodus regularis Branson and Mehl

Pl. 3, Fig. 7

1938, Univ. of Missouri Studies, vol. 13, no. 4, pp. 137, 139, pl. 34, figs. 1-3, 10.

Occurrence: Holts Summit

Figured specimen: Univ. of Missouri, C 943-1

Spathognathodus strigosus Branson and Mehl

Pl. 2, Fig. 12

1934, Univ. of Missouri Studies, vol. 8, no. 3, p. 187, pl. 17, fig. 17.

Occurrence: Holts Summit

Figured specimen: Univ. of Missouri, C 943-2

Family POLYGNATHIDAE

Genus ANCYRODELLA Ulrich and Bassler

Ancyrodella lobata?Branson and Mehl

Pl. 3, Fig. 26

1934, Univ. of Missouri Studies, vol. 8, no. 3, pp. 239-240, pl. 19, fig. 14, pl. 21, figs. 22-23.

No specimens were recovered which possessed the lobe which is missing in the figured specimen, therefore the identification of this specimen must be questionable.

Occurrence: Holts Summit

Figured specimen: Univ. of Missouri, C 943-3

Ancyrodella nodosa Ulrich and Bassler

Pl. 3, Fig. 24

1926, U. S. Nat. Mus. Proc., vol. 68, art. 12, no. 2613, pp. 44, 48, pl. 1, figs. 10-13; fig. 5, subfigs. 8-9.

Occurrence: Holts Summit

Figured specimen: Univ. of Missouri, C 943-4

Ancyrodella robusta Stauffer

Pl. 3, Fig. 25

1938, Jour. Paleont., vol. 12, no. 5, pp. 412,418, pl. 52, figs. 28-29.

Occurrence: Holts Summit

Figured specimen: Univ. of Missouri, C 943-5

Ancyrodella woodsi? Johnson

Pl. 3, Fig. 22

1957, Unpub. Master's thesis, Univ. of Missouri, Columbia, Missouri, p. 62, pl. 3, figs. 11-14.

The figured specimen is questionably referred to this species because it is incomplete, lacking one lobe of the plate.

Occurrence: Holts Summit

Figured specimen: Univ. of Missouri, C 944-1

Genus ANCYROGNATHUS

Ancyrognathus irregularis Branson and Mehl

Pl. 3, Fig. 20

1934, Univ. of Missouri Studies, vol. 8, no. 3, p. 242, pl. 19, figs. 1-2, 4, 10, 16.

Occurrence: Holts Summit

Figured specimen: Univ. of Missouri, C 944-2

Ancyrognathus symmetrica Branson and Mehl

Pl. 3, Fig. 21

1934, Univ. of Missouri Studies, vol. 8, no. 3, p. 240, pl. 19, figs. 7-9.

Occurrence: Holts Summit

Figured specimen: Univ. of Missouri, C 944-3

Genus PALMATOLEPIS Ulrich and Bassler

Palmatolepis distorta Branson and Mehl

Pl. 4, Fig. 5

1934, Univ. of Missouri Studies, vol. 8, no. 3, p. 237, pl. 18, figs. 13-14.

Occurrence: Holts Summit

Figured specimen: Univ. of Missouri, C 944-4

Palmatolepis elongata Holmes

Pl. 4, Fig. 6

1928, U. S. Nat. Mus. Proc., vol. 72, art. 5, no. 2701, p. 33, pl. 11, fig. 13.

Occurrence: Holts Summit

Figured specimen: Univ. of Missouri, C 944-5

Palmatolepis flabelformis Stauffer

Pl. 4, Fig. 4

1938, Jour. Paleont., vol. 12, no. 5, pp. 413, 436-437, pl. 53, figs. 2, 4, 9, 12, 14.

Occurrence: Holts Summit

Figured specimen: Univ. of Missouri, C 945-1

Palmatolepis glabra Ulrich and Bassler

Pl. 4, Fig. 3

1926, U. S. Nat. Mus. Proc., vol. 68, art. 12, no. 2613, p. 51, pl. 9, figs. 18-20.

Occurrence: Holts Summit

Figured specimen: Univ. of Missouri, C 945-2

Palmatolepis minuta Branson and Mehl

1934, Univ. of Missouri Studies, vol. 8, no. 3, p. 236, pl. 18, figs. 1, 6-7.

Occurrence: Holts Summit

Palmatolepis planulata Zalusky, n. sp.

Pl. 4, Fig. 1

The plate; long margin, widely flared lobe in posterior half, anteriorly, straight to end of blade, the short margin, straight in posterior two-thirds, gently lobed in anterior one-third, terminating against blade opposite midpoint of long margin. Plate and blade projecting upward in anterior third. The carina and blade, originating as a low ridge at posterior margin, gradual increase in height to azygous node, anterior to azygous node sharply curved outwardly, reversing curvature to the inward side anteriorly, oral edge of blade serrate. Oral plate ornamentation, fine sinuous reticulate ridges, more or less centered about azygous node. Aborally, keel not prominent but distinct, centered in shallow trough anteriorly.

Occurrence: Holts Summit

Holotype: Univ. of Missouri, C 945-3

Palmatolepis perlobata Ulrich and Bassler

Pl. 4, Fig. 9

1926, U. S. Nat. Mus. Proc., vol. 68, art. 12, no. 2613, p. 24, pl. 7, figs. 19-23.

Occurrence: Holts Summit

Figured specimen: Univ. of Missouri, C 945-4

Palmatolepis quadrantinodosa Branson and Mehl

Pl. 4, Fig. 10

1934, Univ. of Missouri Studies, vol. 8, no. 3, p. 235, pl. 18, figs. 3, 17, 20.

Occurrence: Holts Summit

Figured specimen: Univ. of Missouri, C 945-5

Palmatolepis rugosa Branson and Mehl

Pl. 4, Fig. 2

1934, Univ. of Missouri Studies, vol. 8, no. 3, p. 236, pl. 18, figs. 15-16, 18-19.

Occurrence: Holts Summit

Figured specimen: Univ. of Missouri, C 946-1

Palmatolepis subperlobata Branson and Mehl

Pl. 4, Fig. 8

1934, Univ. of Missouri Studies, vol. 8, no. 3, p. 235, pl. 18, figs. 11, 21.

Occurrence: Holts Summit

Figured specimen: Univ. of Missouri, C 946-2

Palmatolepis undosa Zalusky, n. sp.

Pl. 4, Fig. 7

Plate nearly rhomboid, symmetry of rhomb disrupted by widely flared lobe on long side, posterior margin pointed. Long side undulating, lowest point on margin

anterior to lobe. Short side a serrated ridge, more or less parallel to and higher than the carina, shallow sulcus between ridge and carina, short side terminated anteriorly about mid-length of unit. Carina originating from plate near posterior margin as a low ridge posterior to the azygous node, anterior to the node, sharply curved toward the short side, recurved to the anterior, developing into a high, thin, short, gently curved blade without distinct denticles. Oral surface with minute, sinuous, ridges, more or less parallel to margins. Well developed nodes on long side, ridges which are indistinct or granular on short side. Aboral side flat, keel reflecting course of carina and blade.

Occurrence: Holts Summit

Holotype: Univ. of Missouri, C 946-3

Remarks: This species is considerably smaller than most palmatolipids.

Genus POLYGNATHUS Hinde

Polygnathus alveus Perry

Pl. 1, Fig. 12

1957, Unpub. Master's thesis, Univ. of Missouri, Columbia, Missouri, p. 82, pl. 7, figs. 7-9.

Occurrence: Holts Summit

Figured specimen: Univ. of Missouri, C 946-4

Polygnathus angustidiscus Youngquist

Pl. 2, Fig. 18

1945, Jour. Paleont., vol. 19, no. 4, p. 365, pl. 54, fig. 2.

Occurrence: Holts Summit

Figured specimen: Univ. of Missouri C 946-5

Polygnathus brevilamina Branson and Mehl

Pl. 4, Fig. 24

1934, Univ. of Missouri Studies, vol. 8, no. 3, p. 246, pl. 21, figs. 3-5.

Occurrence: Holts Summit

Figured specimen: Univ. of Missouri, C 947-1

Polygnathus caelatus Bryant

Pl. 1, Fig. 15

1921, Buff. Soc. Nat. Sci., Bull., vol. 13, no. 2, p. 27, pl. 13, figs. 1-13.

Occurrence: Holts Summit

Figured specimen: Univ. of Missouri, C 947-2

Polygnathus communis Branson and Mehl

Pl. 1, Fig. 3

1934, Univ. of Missouri Studies, vol. 8, no. 4, p. 293, pl. 24, figs. 1-4.

Occurrence: Holts Summit

Figured specimen: Univ. of Missouri, C 947-3

Polygnathus granulosa Branson and Mehl

Pl. 4, Fig. 29

1934, Univ. of Missouri Studies, vol. 8, no. 3, p. 246, pl. 20, figs. 21, 23.

Occurrence: Holts Summit

Figured specimen: Univ. of Missouri, C 947-4

Polygnathus gravis Zalusky, n. sp.

Pl. 1, Fig. 10

Plate thick, posterior apex turned sharply aborally, outer margin convex laterally, inner margin slightly convex laterally. The oral surface nodose except posterior third which is smooth. The carina originates at downturning of apex, continues into blade as a coalesced denticulate ridge. The blade thick, slightly longer than plate, consisting of eight to eleven appressed denticles, leading edge rounded. Keel deep, sharp ridged, straight in lateral view. Pit a slit-like depression in keel beneath anterior termination of plate.

Occurrence: Holts Summit

Holotype: Univ. of Missouri, C 947-5

Polygnathus grossus Perry

Pl. 4, Fig. 28

1957, Unpub. Master's thesis, Univ. of Missouri, Columbia, Missouri, p. 88, pl. 8, figs. 1-3.

Occurrence: Holts Summit

Figured specimen: Univ. of Missouri, C 948-1

Polygnathus inconditus Perry

Pl. 1, Fig. 1

1957, Unpub. Master's thesis, Univ. of Missouri, Columbia, Missouri, p. 89, pl. 8, figs. 10-12.

Occurrence: Holts Summit

Figured specimen: Univ. of Missouri, C 948-2

Polygnathus inelegans Perry

Pl. 1, Fig. 4

1957, Unpub. Master's thesis, Univ. of Missouri, Columbia, Missouri, p. 90, pl. 7, figs. 16-18.

Occurrence: Holts Summit

Figured specimen: Univ. of Missouri, C 948-3

Polygnathus largus Perry

Pl. 1, Fig. 17

1957, Unpub. Master's thesis, Univ. of Missouri, Columbia, Missouri, p. 91, pl. 7, figs. 10-12.

Occurrence: Holts Summit

Figured specimen: Univ. of Missouri, C 948-5

Polygnathus latus Perry

Pl. 1, Fig. 18

1957, Unpub. Master's thesis, Univ. of Missouri, Columbia, Missouri, p. 92, pl. 8, figs. 19-21.

Occurrence: Holts Summit

Figured specimen: Univ. of Missouri, C 948-5

Polygnathus nodocostata Branson and Mehl

Pl. 1, Fig. 16

1934, Univ. of Missouri Studies, vol. 8, no. 3, p. 246, pl. 20, figs. 9-12, pl. 21, fig. 15.

Occurrence: Holts Summit

Figured specimen: Univ. of Missouri, C 949-1

Polygnathus psuedocommunis Zalusky, n. sp.

Pl. 1, Fig. 7

Plate cuneate, thin, convex anterio-posteriorly, three to seven nodes on anterior portion of the inner lobe, two or three on anterior portion of outer lobe, remainder of plate smooth. Carina originating at the posterior margin as a low continuous series of five to eight coalesced nodes, increasing in height anteriorly. Blade continuous with carina, blade denticles, about fourteen, coalesced, with short free apices. Blade and platform about equal in length. Axis of carina and blade gently curving laterally. In aboral view, pit small, elongate anterio-posteriorly, located in the anterior third of plate; keel small but distinctly developed, continuous from pointed posterior into blade.

Oral ornamentation may be poorly developed, entirely absent, or restricted to inner side only.

Occurrence: Holts Summit

Holotype: Univ. of Missouri, C 949-2

Polygnathus cf. rhomboidea Ulrich and Bassler

Pl. 1, Fig. 2

1926, U. S. Nat. Mus. Proc., vol. 68, art. 12, no. 2613, p. 46, pl. 7, fig. 6.

This specimen compares with the holotype except the ornamentation consists of ridges instead of alined nodes.

Occurrence: Holts Summit

Figured specimen: Univ. of Missouri, C 949-3

Polygnathus sanduskiensis Stauffer

Pl. 1, Fig. 19

1938, Jour. Paleont., vol. 12, no. 5, p. 413, pl. 53, figs. 27, 36-37.

Occurrence: Holts Summit

Figured specimen: Univ. of Missouri, C 949-4

Polygnathus semicostata Branson and Mehl

Pl. 1, Fig. 6

1934, Univ. of Missouri Studies, vol. 8, no. 3, p. 247, pl. 21, figs. 1-2.

Occurrence: Holts Summit

Figured specimen: Univ. of Missouri, C 949-5

Polygnathus sinelamina? Branson and Mehl

Pl. 4, Fig. 30

1934, Univ. of Missouri Studies, vol. 8, no. 3, p. 248, pl. 20, figs. 20, 22.

An incomplete specimen, appears to conform to specific description of P. sinelamina except the oral ornamentation is in the form of ridges instead of nodes.

Occurrence: Holts Summit

Figured specimen: Univ. of Missouri, C 950-1

Polygnathus subserrata Branson and Mehl

Pl. 1, Figs. 9, 13

1934, Univ. of Missouri Studies, vol. 8, no. 3, p. 248, pl. 20, figs. 17-19.

Juvenile forms are difficult to recognize as members of this species. The pit is the size possessed by mature individuals and the ridges have not as yet formed but are distinct nodes as in some icriodids. Specimens representing all stages of growth were recovered and a mature specimen is shown in figure 13. The aboral view of a juvenile specimen is shown in figure 9.

Occurrence: Holts Summit

Figured specimens: Univ. of Missouri, C 950-2, C 950-3

Polygnathus subtrigona Zalusky, n. sp.

Pl. 1, Fig. 14

Plate triangular in outline with downturned apex. The carina originates at the apex as a series of nodes,

progressing anteriorly with regular increase in height. Blade composed of eight laterally compressed denticles. In lateral view the aboral outline arched and the blade is straight. The oral side trough-like with mid-width carina that reaches the height of lateral margins of plate. Plate ornamented with about eight ridges on each side normal to the carina and decreasing in height and width towards carina. One anterior margin of the plate normal to the carina, the other at an acute angle facing forward and flared out and downward forming a sulcus at the junction of blade and plate which deepens anteriorly. Keel prominent in posterior portion of plate, disappearing at apex of arch, shallow subcircular pit at arch which continues anteriorly on the aboral edge of the blade as a narrow groove.

Occurrence: Holts Summit

Holotype: Univ. of Missouri, C 950-4

Polygnathus triangularis Branson and Mehl

Pl. 1, Fig. 11

1934, Univ. of Missouri Studies, vol. 8, no. 3, p. 247, pl. 21, figs. 16, 20.

Occurrence: Holts Summit

Figured specimen: Univ. of Missouri, C 950-5

Polygnathus varinodosa Branson and Mehl

Pl. 1, Fig. 5

1934, Univ. of Missouri Studies, vol. 8, no. 3, p. 249, pl. 20, fig. 15, pl. 21, figs. 9, 11, 12, 18.

Occurrence: Holts Summit

Figured specimen: Univ. of Missouri, C 951-1

Polygnathus? sp. ind.

Pl. 1, Fig. 8

This is represented by a fragment of what appears to be the anterior portion of a polygnathid and is included because of its unusual form. It is marked by low node-like denticles grouped as an offset carina on a laterally curving narrow platform. Keel deep and sharp. Anterior outline in lateral view rounded, suggesting the prow of a canoe.

Occurrence: Holts Summit

Figured specimen: Univ. of Missouri, C 951-2

Remarks: This was the only fragment of this form recovered.

Genus POLYLOPHODONTA Branson and Mehl

Polylophodonta concentrica Branson and Mehl

Pl. 1, Fig. 20

1934, Univ. of Missouri Studies, vol. 8, no. 3, p. 243, pl. 20, fig. 2.

1926, (Polygnathus concentrica) Ulrich and Bassler, U. S. Nat. Mus. Proc., vol. 68, art. 12, no. 2613, p. 47, pl. 8, figs. 6-7.

Occurrence: Holts Summit

Figured specimen: Univ. of Missouri, C 951-3

Polylophodonta crassa Zalusky, n. sp.

Pl. 3, Fig. 19

The plate lanceolate, thick, sharp pointed posterior lobe, symmetrically lobed in anterior portion, convex longitudinally, lateral margins downturned. The carina originating at posterior as low ridge with little increase in height, anteriorly continuous with blade. Blade form unknown. Plate ornamentation, inner nodose ridges and lateral rows of nodes of anterior plate parallel carina, posteriorly turn abruptly and cross carina as well developed coarse ridges. The keel low at apex, increasing in height posteriorly and anteriorly. Pit small but well developed as elongation in keel at apex.

Occurrence: Holts Summit

Holotype: Univ. of Missouri, C 951-4

Polylophodonta gyratlineata Branson and Mehl

Pl. 3, Fig. 23

1934, Univ. of Missouri Studies, vol. 8, no. 3, p. 242, pl. 20, fig. 3.

1928, (Polygnathus gyratlineata) Holmes, U. S. Nat. Mus. Proc., vol. 72, art. 5, no. 2701, p. 31, pl. 11, fig. 1.

Occurrence: Holts Summit

Figured specimen: Univ. of Missouri, C 951-5

Polylophodonta linguformis Branson and Mehl

Pl. 1, Fig. 22

1934, Univ. of Missouri Studies, vol. 8, no. 3, p. 244, pl. 20, figs. 1, 6-7.

Occurrence: Holts Summit

Figured specimen: Univ. of Missouri, C 952-1

Polylophodonta rugosa Branson and Mehl

Pl. 1, Fig. 21

1934, Univ. of Missouri Studies, vol. 8, no. 3, p. 244, pl. 20, figs. 4-5.

Occurrence: Holts Summit

Figured specimen: Univ. of Missouri, C 952-2

Family GNATHODIDAE

Genus ICRIODUS Branson and Mehl

Icriodus alternatus Branson and Mehl

Pl. 4, Fig. 13

1934, Univ. of Missouri Studies, vol. 8, no. 3, p. 225, pl. 13, figs. 4-6.

Occurrence: Holts Summit

Figured specimen: Univ. of Missouri, C 952-3

Icriodus curvatus Branson and Mehl

Pl. 4, Fig. 15

1938, Jour. Paleont., vol. 12, no. 2, pp. 156, 158, 162-164, pl. 26, figs. 23-26.

Occurrence: Holts Summit

Figured specimen: Univ. of Missouri, C 952-4

Icriodus planus (Sannemann)

Pl. 4, Fig. 12

1955, (Pelekysgnathus planus) Senckenbergiana Lethaea, band 36, p. 149, taf. 1, figs. 1-3.

Diagnose: Eine einreihige Art der Gattung Pelekysgnathus mit gerader oraler Kante.

Beschreibung: Eine stark verschmolzene Zahnreihe, nur die obersten Spitzen der Zahnchen frei, am Hinterende aus mehreren Zahnchen veschmolzener hornartiger Fortsatz. In der Seitenansicht orale Kante flach convex, nur am Vorderende etwas starker abfallend; aborale Kante parallel, am Hinterende starker abfallend und mit einer kleinen Lippe unter einem Winkel von 90 (degrees) mit der Hinterkante des Forsatzes zusammentreffend. Aborale Seite tief ausgehohlt, nach hinten stark verbreitert, in der Aufsacht

tropfenformig. Bei Jugendexemplaren (Taf. 4 Fig. 23) sind die Zahnchen noch nicht so weit verschmolzen und im verwachsenen Teil noch gut sichtbar; der hinterste Zahn ist kraftiger und etwas nach hinten geneigt.

Occurrence: Holts Summit

Figured specimen: Univ. of Missouri, C 952-5

Icriodus symmetricus Branson and Mehl

Pl. 4, Fig. 16

1934, Univ. of Missouri Studies, vol. 8, no. 3, p. 226, pl. 13, figs. 1-3.

Occurrence: Holts Summit

Figured specimen: Univ. of Missouri, C 953-1

Icriodus sp. ind.

Pl. 4, Fig. 14

A fragmentary specimen with unusual oral ornamentation. Oral surface crossed by interconnecting ridges originating at lateral nodes, terminated at nodes on opposite side or interconnected with closest cross ridge.

Occurrence: Holts Summit

Figured specimen: Univ. of Missouri, C 953-2

Genera Not Assigned to Families

Genus SCUTULA Sannemann (1955)

Scutula venusta Sannemann

Pl. 4, Figs. 18, 22

1955, Senckenbergiana, Lethaea, band 36, p. 155, taf. 4, figs. 6a, b; 7.

Diagnose: Eine Art der Gattung Scutula mit einem Vorderast.

Beschreibung: Blatt aus feinen, bis fast an die Spitzen verwachsenen Zähnchen, die in der Mitte am grössten sind; kein deutlich hervorgehobener Hauptzahn. Orale Kante ungefähr umgekehrt V-förmig; aborale Kante halbkreisförmig. Vorderast mehr oder minder weit nach unten gezogen, besetzt mit feinen, vereinzelt auch kräftigeren Zähnchen. Basalgrube nicht vorhanden.

Bemerkungen: Diese Art ist äusserst variabel. Das Blatt kann vollkommen asymmetrisch werden, gleicht dann Falcodus variabilis n. sp. und ist nur durch das Vorhandensein des Vorderastes von diesem unterschieden.

Occurrence: Holts Summit

Figured specimens: Univ. of Missouri, C 953-3, C 953-4

Genus "A", n. gen.

Comparatively small, arched or straight, laterally curved or straight, blade, or plate-like units with carina or blade consisting of laterally fused relatively long, wide denticles. Posterior part of blade more or less platform-like, the result of a lateral shelf developed by a group of closely crowded bristle-like denticles which give the unit a brush-like appearance. The lateral shelves may or may not be present on both sides of the blade, but if present on both sides, the development is unequal.

Remarks: For purposes of orientation the side possessing the shelf, or largest shelf if two are present, is considered to be the inner side.

There is some question as to the validity of this genus inasmuch as the representatives of this development resemble in general appearance, several genera such as Nothognathella, Polygnathus, and Spathognathodus. The brush-like development is sparsely represented in the fauna, all specimens are exceptionally small and conceivably might be pathological growth.

Occurrence: Holts Summit

Genus "A" sp. A

Plate 4, Fig. 20

Incomplete specimen with anterior portion of blade missing.

Platform slightly elliptical anterio-posteriorly, pointed posterior, short sulcus between blade and inner lateral margin. Aboral outline in lateral view slightly concave upward beneath platform, blade aboral edge straight, outline of posterior descending downward and rounded on aboral side. Blade denticles, three to four times wider than diameter of margin denticles, increasing in height anteriorly, laterally fused. Margin denticles equal, slightly separated, larger and higher than interior platform denticles.

Occurrence: Holts Summit

Figured specimen: Univ. of Missouri, C 953-5

Genus "B" n. gen.

Comparatively small "L" shaped plate-like units, with carina extending full length of narrow plate as distinct closely appressed denticles, progressing uninterrupted into aborally directed blade. Plate anterior to bend of "L" gradually narrowing and terminated at juncture with free blade. Oral surface very finely granulose. Aboral surface gently convex. Keel corresponds to position of carina.

Occurrence: Holts Summit

Genus "B" sp. A

Plate 4, Fig. 19

Minute form, narrow plate, rounded at posterior. Plate denticles equal, short, as a continuous carina originating just anterior to posterior margin, continuous with blade denticles. Plate and blade denticles, about thirty-five. Blade downcurved by deepening of aboral surface. Plate finely granulose, merged into blade at about the fourth denticle from the anterior. Aboral surface convex downward in cross section, keel corresponding to carina, pit absent.

Occurrence: Holts Summit

Figured specimen: Univ. of Missouri, C 954-1

Genus "C", n. gen.

Compound units consisting of a thin, blade-like bar, the posterior half of which is bowed and twisted inwardly. The anterior series of denticles, large, subequal; posterior series small, progressively increasing in height posteriorly. Denticles wide at base, discrete, closely appressed or partly fused, laterally compressed with sharp anterior and posterior edges. Aboral edge of blade sharp, pit at mid-length with laterally flared flanges of small size.

Remarks: This form is closely allied to the genus Ozarkodina, differing chiefly in its straight rather than arched form and absence of a superior mid-length or apical denticle, features characteristic of Ozarkodina.

Occurrence: Holts Summit

Genus "C" sp. A Zalusky, n. sp.

Pl. 3, Fig. 6

1955, (Ozarkodina regularis) Sannemann, Senckenbergiana Lethaea, band 36, p. 133, taf. 6, fig. 5.

Blade thin, bar-like units, anterior half straight in oral view; posterior half bowed and rotated inwardly. The denticles, about six in anterior series, three or four of these the largest of unit, wide at base, slightly separated, posterior series, about eight,

reclining toward posterior. All denticles compressed with pointed apices, sharp anterior and posterior edges. Lateral outline of anterior edge angular, striking aboral edge at about 90 degrees or less. Aboral edge sharp. The pit, elliptical, at mid-length, small, laterally flanged, more so inwardly.

Occurrence: Holts Summit

Figured specimen: Univ. of Missouri, C 954-2

LIST OF COLLECTING LOCALITIES

1. Small falls in creek bed, NE ¼, NW ¼, SE ¼, Sec. 11, T. 45 N., R. 11 W.
2. Small falls in creek bed, SW ¼, NE ¼, SE ¼, Sec. 11, T. 45 N., R. 11 W.
3. North creek bank, NE ¼, SE ¼, SE ¼, Sec. 11, T. 45 N., R. 11 W.
4. Creek bed, SW ¼, SE ¼, SE ¼, Sec. 11, T. 45 N., R. 11 W.
5. South creek bank, SE ¼, SW ¼, SE ¼, Sec. 14, T. 45 N.
6. Creek bottom, SW ¼, NE ¼, NE ¼, Sec. 23, T. 45 N., R. 11 W.
7. Creek bottom, SW ¼, NE ¼, NE ¼, Sec. 26, T. 45 N., R. 11 W.
8. Falls in creek bottom, NE ¼, SW ¼, SE ¼, Sec. 22, T. 45 N., R. 11 W.
9. Falls in creek bottom, SW ¼, NW ¼, SE ¼, Sec. 22, T. 45 N., R. 11 W.

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All figures x50 unless otherwise stated.

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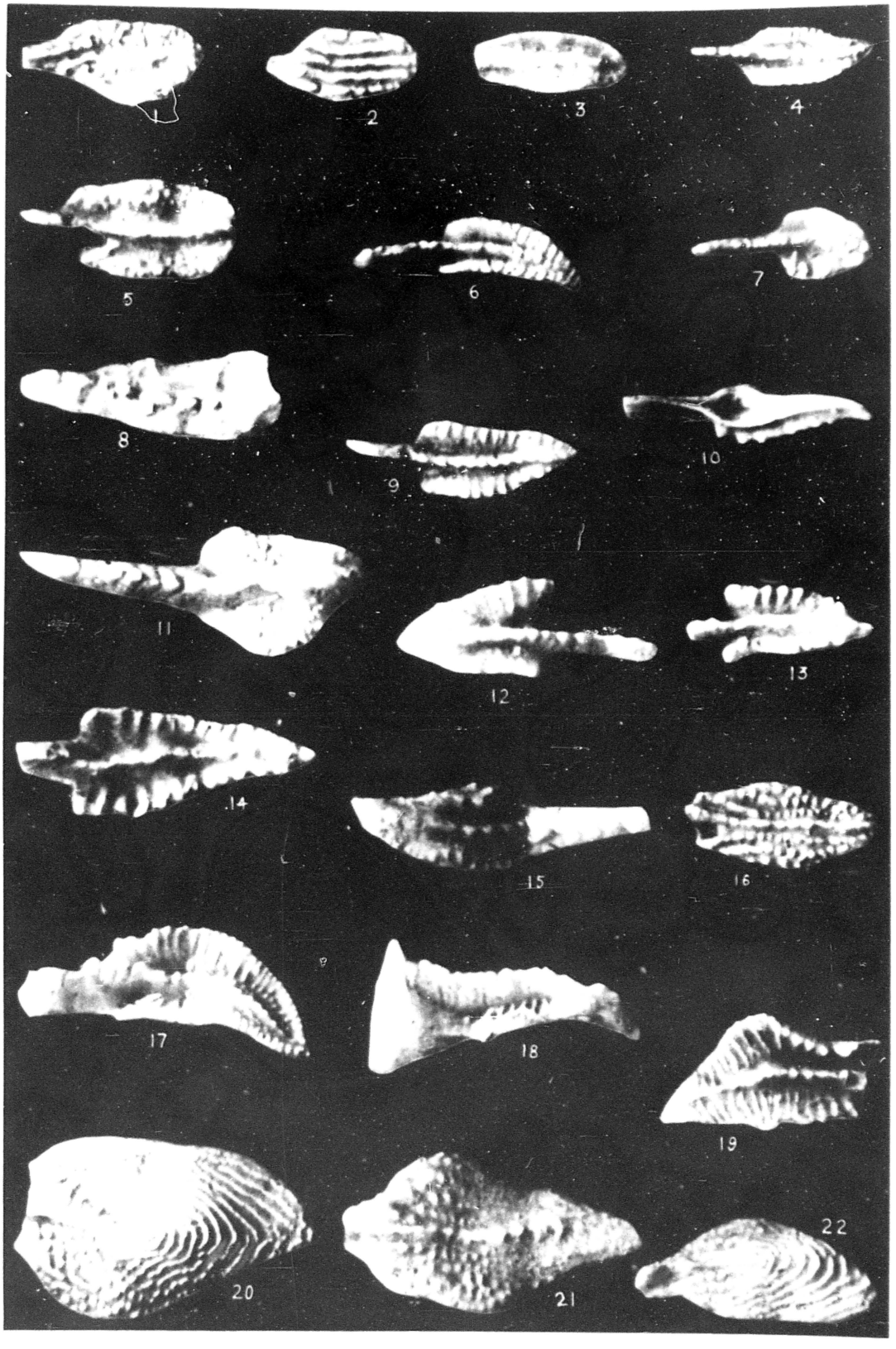
PLATE 1



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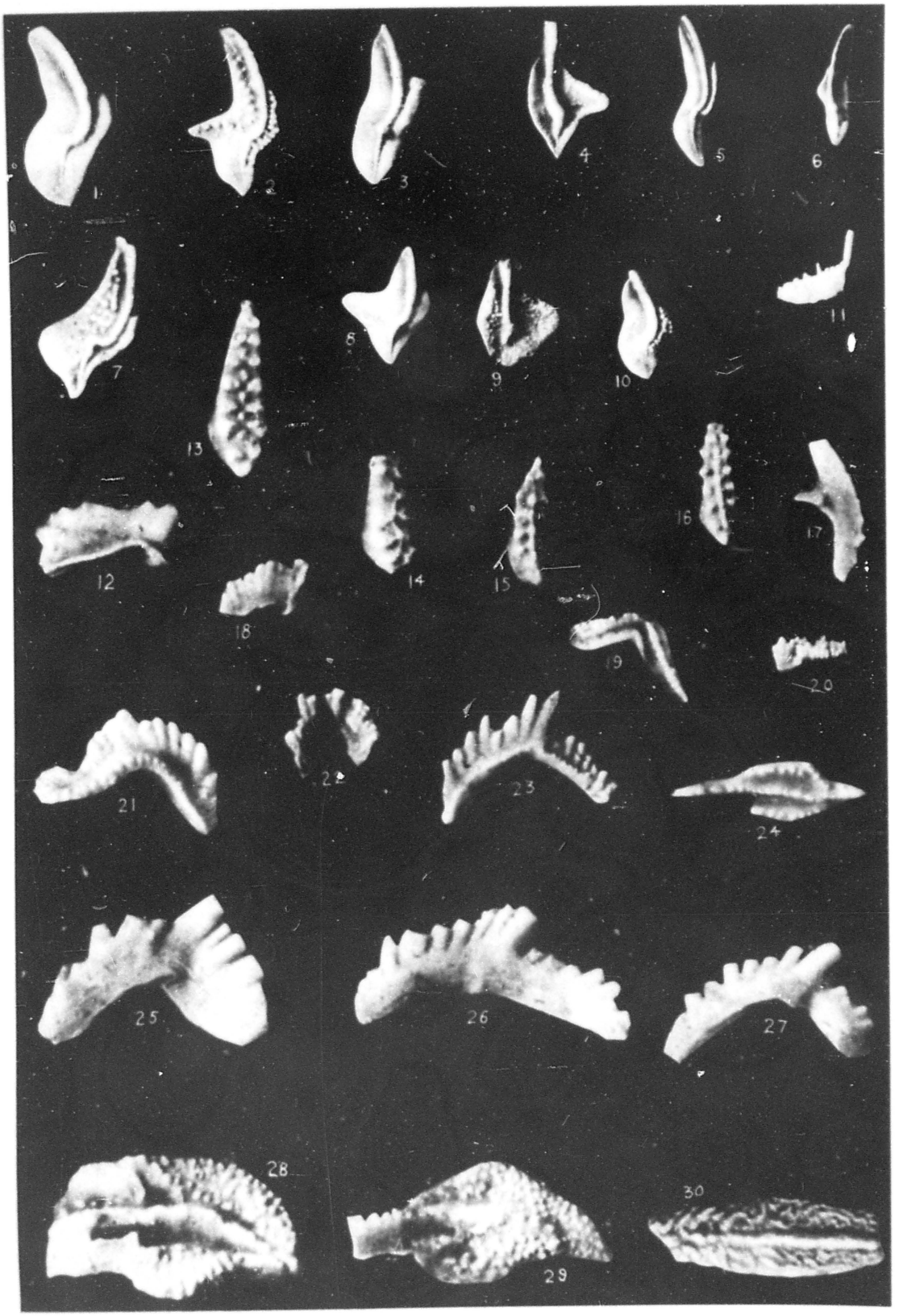
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APPENDICES

APPENDIX I

Genus Scutula Sannemann

Diagnosis: In the form of a dish, more or less grown together, blade with one or two front branches.

Scutula venusta Sannemann

Diagnosis: A type of the genus Scutula with one front blade.

Description: Blade consists of fine, small teeth which are grown together almost up to the tips, are largest in the middle; no main tooth that is clearly raised above the surface. The oral edge is in the approximate form of a turned over "V"; the aboral edge is semicircular. Front branch is more or less considerably pulled down, covered with fine, and also isolated strong, small, teeth. There is no basal pit.

Remarks: This type is extremely variable. The blade can become completely asymmetrical, it then resembles the Falcodus variabilis (Sannemann) and can be differentiated from this one only by the presence of the front branch.

APPENDIX II

Icriodus planus

Pelekysgnathus planus Sannemann

Diagnosis: A single row type of the genus Pelekysgnathus with straight edge.

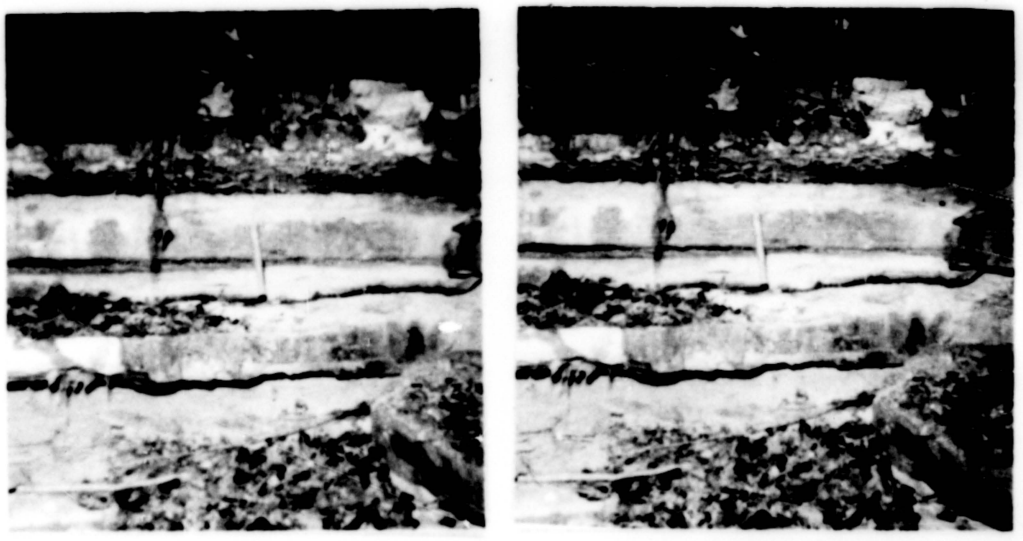
Description: A strongly blended row of teeth, only the upper tips of the small teeth are free, at the posterior end is a horn-like appendix consisting of several blended small teeth. In the lateral view the oral edge is shallowly convex, only at the front end it is somewhat more receding: The aboral edge is parallel, more receding at the posterior end and with a small lip under an angle of 90 degrees it meets with the rear edge of the appendix. The aboral side is deeply excavated, strongly broadened to the rear, in the form of a drop from the upper view. In juvenile specimens (plate 4, fig. 23) the small teeth are not blended so much and are still visible also in the grown together part: The tooth at the very rear is stronger and inclined somewhat backward.

APPENDIX III

Angulodus bidentatus Sannemann

Diagnosis: A type of Angulodus that distinguishes itself through a strong, small tooth on the front branch.

Description: Slender main tooth. Rear branch is approximately one-third longer than this one, closely covered with small teeth which increase in size toward the rear: Tooth coverage on the rear margin of the main tooth is somewhat pulled upward. The front branch is approximately one-half as long as the rear branch, the aboral edge forming a line with the rear edge of the main tooth: covered with slender teeth, bent somewhat to the rear, which increase in size from the main tooth to the middle and then decrease again. The largest small tooth is approximately two-thirds of the main tooth.



Stereoscopic Photo Pair of a Holts Summit Exposure

SE ¼, SW ¼, SE ¼, Sec. 14, T. 45 N., R. 11 W.

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