

A CLASSIFICATION OF THE TOOTHLIKE FOSSILS,
CONODONTS, WITH DESCRIPTIONS OF AMERICAN
DEVONIAN AND MISSISSIPPIAN SPECIES

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A discussion of the systematic position of the conodonts formed the basis of the senior author's first paper published in 1878¹. At various times since that date, and during the past 20 years in association with the junior author, he has made quite extensive collections and studies of these difficult toothlike organisms. In his first paper, the senior author accepted somewhat reluctantly the prevailing opinion that the conodonts, like the more unquestionable annelid jaws, were the hooklets of species of annelids. In the subsequent comparison the true conodonts were early discriminated from the annelid jaws by him but until the present time no opportunity has been afforded to prepare and publish the results of these studies. The main intention of the present publication is to make these conodonts more available for detailed stratigraphic work by introducing a comprehensive classification. That this classification may be to some extent artificial is recognized. However, after extending our studies to such recent fishes as the Myxines and small selachians in which similar teeth and dermal plates occur, we feel certain the prevalent opinion that many kinds of these teeth may occur in the same mouth, or plates in the same dermal armor, is not warranted by the facts. Except that there are right and left pairs belonging in the case of teeth, to the right and left sides of the upper and lower jaw, the minute teeth wherever located in the mouth of the supposed living relatives of the conodonts, are essentially alike and thus each kind is characteristic of some particular genus and species. The dermal ossicles or plates are similarly divisible into right and left pairs but aside from this difference in addition to the easily

¹ *Journal Cincinnati Society Natural History*, vol. 1, 1878, pp. 87-91.

recognizable changes due to age, the many thousands covering the skin of a single fish are practically alike. So far then as we can learn from living fishes, the statement made on various occasions that no two of these teeth or dermal plates are exactly alike is utterly groundless. Moreover it is emphatically negated by certain of our collections that contain thousands of examples absolutely indistinguishable in structural details except that one set is curved to adapt it to the right side and another the left side precisely as we found them in the supposedly related recent fishes.

The systematic position of the conodonts has been discussed and reviewed by several authors. A history of this discussion as well as a bibliographic index, including illustrations of the described species, forms a part of a paper by Grace B. Holmes now in course of publication. As indicated above, we believe the conodonts to be the teeth of primitive fishes and not necessarily all of the same group. For example as shown on plate 11, illustrating the teeth and dermal plates of certain recent fishes, *Distacodus* and its allies seem to be related to the Myxines while the more complicated Prioniodidae and Prioniodinidae show resemblance to the Selachians. The plates described under *Polygnathus* and related genera certainly exhibit much resemblance to the dermal plates of recent sharks and should perhaps not be classified with the toothlike, true conodonts. However as no true conodonts are known in Post Paleozoic strata it is possible they belong to an extinct group of fishes.

In our descriptions, we have considered the typical conodonts as composed of a basal portion or bar, upon which are arranged one or more denticles. One of the denticles may be more developed than the rest in which case it is termed the main cusp. For convenience in comparison, the illustrations have been arranged so that the bar is in a horizontal position. We have further considered that the downwardly bent portion of the bar when this is present, represents the anterior end upon the assumption that this end marked the attachment in the jaw.

Our generic studies have been based upon large collections of Devonian and Mississippian conodonts from many States, particularly from New York, Kentucky, Tennessee, Virginia, Alabama, Arkansas, and Ohio. All of these collections have been studied sufficiently to give a general idea of their contents, the purpose of this preliminary study being to determine whether any of the species from beds supposed to be of Mississippian age, contain anything exactly corresponding to those from known Devonian beds. We have failed to find a single instance of forms structurally identical in these two periods so that the conodonts have contributed most

conclusive paleontologic data concerning the age relation of the various Devonian and Mississippian black shale formations. In other words, none of the Genesee and Portage conodonts from New York localities could be accurately identified in the equally large conodont faunas from the Ohio black shale in Ohio, the major upper part of the New Albany black shale in Kentucky, or in the Chattanooga shales in East and Central Tennessee and Alabama. On the other hand many of the New York Devonian species of conodonts were satisfactorily recognized in unquestioned Devonian black shales that underlie 400 to 500 feet of Chattanooga shales in southwestern Virginia. Some of the same and other New York species are represented also in the locally developed basal parts of the New Albany shale of Kentucky in which they are associated with such other typical Devonian fossils as *Schizobolus truncata* (Hall). In so far then as the evidence of the conodonts is concerned, the post-Devonian age of the Chattanooga and Ohio shales, as long advocated by the senior author, seems conclusively established.

Two faunas, one of Upper Devonian age and the other from the basal Mississippian rocks, were selected for description at the present time; first, on account of the abundance and excellent preservation of the specimens; second, because the many species in these faunas gave us the opportunity to test the validity of our new genera; and, lastly, the two horizons represented made it possible to determine the value of the conodonts as index fossils. The Devonian fauna was obtained in the black Rhinestreet shale of the Portage group at Shaleton, Erie County, N. Y., a small station on the Buffalo and Lake Erie traction line about 14 miles southwest of Buffalo. Here, according to Mr. Raymond R. Hibbard, an enthusiastic paleontologist of Buffalo, who collected the specimens and generously presented the United States National Museum with ample material for study, the Rhinestreet shale is about 12 feet thick and almost barren of fossils except in the basal 10 inches, where the conodonts abound. Mr. Hibbard's efforts in promoting the study of the conodonts are to be commended, and we have had pleasure in naming the fine new genus *Hibbardeila* in his honor. The second fauna was collected by the writers some years ago at Mount Pleasant, Tenn., in the Hardin sandstone, a thin more or less phosphatic basal sandstone forming the introductory member of the Mississippian-Chattanooga black shale in central Tennessee.

As noted above, the conodonts have not been employed in detailed correlation to the extent that they deserve because of erroneous impressions as to their variability and long range. We believe that if carefully prepared and discriminated, they will be found as

valuable in stratigraphic work as any group of organisms and because of their minute size they will be as useful in subsurface investigations as the foraminifera, bryozoa, and ostracoda.

METHODS OF STUDY

Perhaps in no other group of fossils is delicate preparatory work more necessary than here. In the black shales, in which most conodonts occur, this preparation is easily carried out, requiring only a steady hand and careful manipulation of tools. It is especially essential that the ends of the teeth or plates be carefully uncovered, for broken specimens or those more or less obscured by matrix can not be classified accurately, because fragmentary or exposed parts are often quite alike in otherwise dissimilar species and genera. Thus the main cusp of *Prioniodus*, *Bryantodus*, *Hibbardella*, and several other genera might readily be mistaken for the simple forms of *Drepanodus*. Several genera have been founded by earlier writers upon fragments of the denticulated bar and it will be impossible to place these with any degree of finality until entire specimens from the same locality and horizon have been studied.

Conodonts often occur in great numbers in basal sandstones or conglomerates where naturally they are more liable to be broken. Here, however, careful work will bring out many complete examples as is shown by our present studies upon the Hardin sandstone, the basal division of the Mississippian in central Tennessee. Free specimens are not always satisfactorily determined because they are more frequently imperfect. Such specimens are most valuable when during the course of preparation they can be freed from the matrix. However, even imperfect, free specimens can be accurately classified when complete examples of the teeth have previously been studied and illustrated.

After their preparation, the further study of the conodonts is much facilitated by whitening them with ammonium chloride and photographing them at a uniform magnification. By this method the individual specimens are thus made much more available for comparisons. The method of whitening the specimens has been described by the authors before, but for the sake of completeness we again insert a diagram of the apparatus and a few remarks as to the process.

By blowing through the mouthpiece *M*, the fumes of hydrochloric acid (HCl) and ammonium hydrate (NH₄OH) will unite at the outlets of the tubes *O*, and form a white sublimate of ammonium chloride upon any object held at this point. This sublimate can be deposited in such a uniform thin film, varying in color according to its thickness from a light blue to an ivory white, that all the details

of the surface are reproduced perfectly and can be viewed under the microscope without exhibiting any crystalline structure of the ammonium chloride. The white sublimate can be removed by simply blowing the breath upon the object so coated. The hydrochloric acid and ammonia used should be of great strength to secure the best results. Small quantities only should be employed so that the bottle

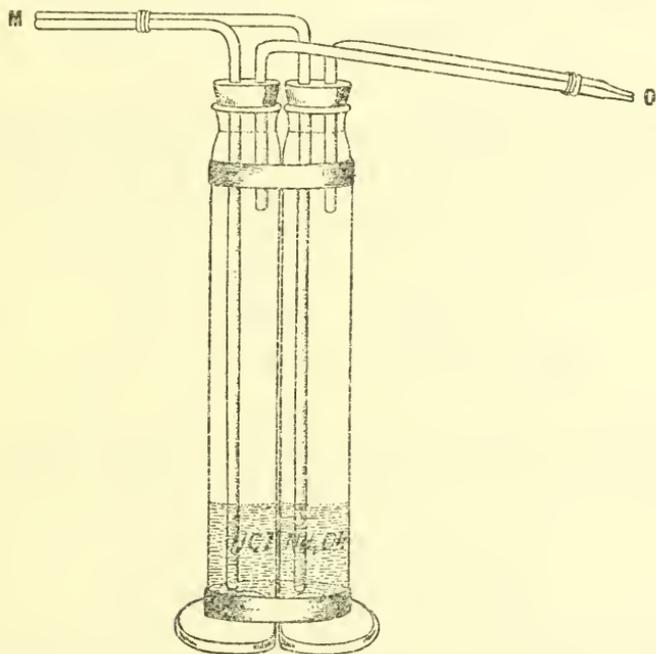


FIG. 1.—APPARATUS FOR PREPARATION OF AMMONIUM CHLORIDE SUBLIMATE

can be emptied and dried frequently, as the reagents not only absorb moisture but lose their strength in a day of use.

CLASSIFICATION

Our classification of the conodonts is summarized in the following table. Descriptions of the new families and new genera with text figures illustrating their characteristics are contained in the following systematic descriptions.

Class PISCES

TYPICAL CONODONTS (teeth of primitive fishes)

Family DISTACODIDAE, new family

Distacodus Hinde, 1879 (*Machairodus* Pander, 1856, preoccupied; *Machairodia* Smith, 1907); *Acodus* Pander, 1856; *Acontiodus* Pander,

1856; *Drepanodus* Pander, 1856; *Scolopodus* Pander, 1856; *Oistodus* Pander, 1856; *Paltodus* Pander, 1856.

Family PRIONIODIDAE, new family

Prioniodus Pander, 1856; *Subprioniodus* Smith, 1907; *Cordylodus* Pander, 1856; *Belodus* Pander, 1856; *Ligonodina*, new genus.

Family PRIONIODINIDAE, new family

Cornuramia Smith, 1907; *Hindcodella*, new genus; *Pachysomia* Smith, 1907; *Lonchodina*, new genus; *Prioniodina*, new genus; *Prioniodella*, new genus; *Bryantodus*, new genus; *Euprioniodina*, new genus; *Hibbardella*, new genus; *Lonchodus* Pander, 1856; *Valentia* Smith, 1907; *Prionognathus* Pander, 1856; *Palmatodella*, new genus; *Diplododella*, new genus; *Synprioniodina*, new genus.

FISH PLATES (dermal plates)

Family POLYGNATHIDAE, new family

Polygnathus (Hinde) Bryant, 1921; *Ancyrodella*, new genus; *Palmatolepis*, new genus; *Panderodella*, new genus; *Polygnathellus*, new genus; *Gnathodus* Pander, 1856; *?Utenognathus* Pander, 1856.

SYSTEMATIC DESCRIPTIONS

DISTACODIDAE, new family

Conodonts consisting of a single, more or less oval tooth or main cusp with a small undenticulated basal expansion.

Distacodus Hinde, 1879 (*Machairodus* Pander, 1856, preoccupied, *Machairodia* Smith, 1907) *Acodus* Pander, 1856, *Acontiodus* Pander, 1856, *Drepanodus* Pander, 1856, *Scolopodus* Pander, 1856, *Oistodus* Pander, 1856, and *Paltodus* Pander, 1856 are referred to this family which comprises the simplest forms of conodonts. The differences between these genera as defined by Pander, are based upon the general shape and curvature of the tooth and particularly upon its cross section. These differences are shown in our text figure but without specimens of these various types of structure we will not attempt to give generic diagnosis.

Genus DISTACODUS Hinde, 1879

DISTACODUS RECTUS, new species

Plate 9, fig. 22

A simple, rather straight, elongate tooth, slightly flaring at base, with an obtusely rounded ridge on the inner and outer sides and a more sharply keeled one on the concave posterior side or edge.

Occurrence.—Mississippian (Hardin sandstone basal member of the Chattanooga shale); Mount Pleasant, Tenn.

Holotype.—Cat. No. 10982, U.S.N.M.

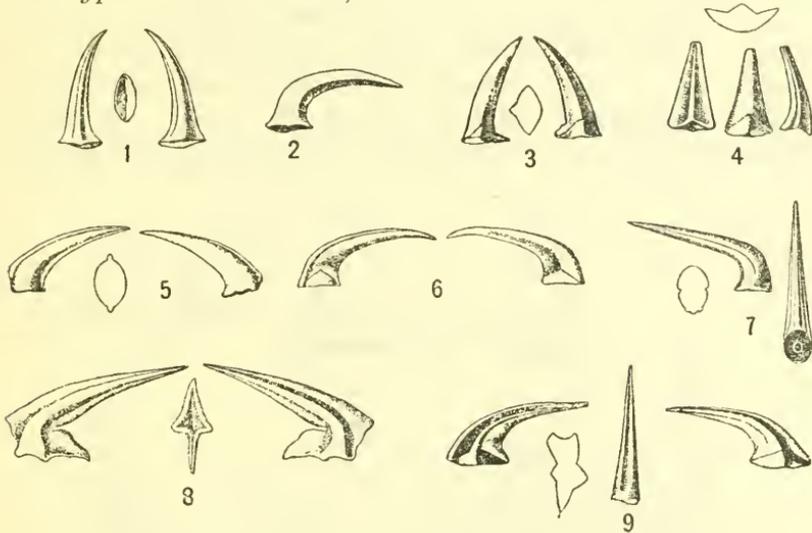


FIG. 2.—DISTACODIDAE, NEW FAMILY

- 1, 2. Genus *Distacodus* Hinde, 1879 (*Machairodus* Pander, 1856. Preoccupied, *Machairodia* Smith, 1907). (1) Lateral and basal views of *Distacodus* (*Machairodus*) *incurvus* Pander, 1856, selected by S. A. Miller as genotype. (2) Lateral view of *Distacodus* (*Machairodus*) *rhomboides* Pander, 1856. Both from Lower Ordovician of Baltic Provinces.
3. Genus *Acodus* Pander, 1856. Opposite sides of tooth of genotype (first species) *Acodus erectus* Pander, 1856, and a transverse section of *Acodus acutus* Pander, 1856. Lower Ordovician of Baltic Provinces.
4. Genus *Acontiodus* Pander, 1856. Three views and transverse section of the genotype (first species) *Acontiodus latus* Pander, 1856. Lower Ordovician of Baltic Provinces.
- 5, 6. Genus *Drepanodus* Pander, 1856. (5) Opposite sides of tooth of *Drepanodus inflexus* Pander, 1856, and a transverse section of *Drepanodus flexuosus* Pander, 1856. (6) Views of *Drepanodus arcualus* Pander, 1856. Lower Ordovician of Baltic Provinces.
7. Genus *Scolopodus* Pander, 1856. Views and cross section of the genotype (first species) *Scolopodus sublacvis* Pander, 1856. Lower Ordovician, Baltic Provinces.
8. Genus *Oistodus* Pander, 1856. Lateral and transverse views of the genotype (first species) *Oistodus lanceolatus* Pander, 1856. Lower Ordovician of Baltic Provinces.
9. Genus *Paltodus* Pander, 1856. Three views and cross section of the genotype (first species) *Paltodus subequalis* Pander, 1856. Lower Ordovician of Baltic Provinces.

PRIONIODIDAE, new family

Conodonts somewhat pick shaped in which the handle or bar (posterior part) is denticulated and the anterior part consists of a

strongly developed main cusp usually with a variously modified undenticulated downward extension.

In this family the tooth consists of a main cusp followed posteriorly by a bar of greater or less length, denticulated along its upper margin. *Prioniodus* Pander, 1856, *Subprioniodus* Smith, 1907, *Belodus* and *Cordylodus* Pander, 1856, and *Ligonodina*, new genus, exhibit the structure characteristic of the family. In all these genera the main cusp is well marked, but the denticulated bar ranges

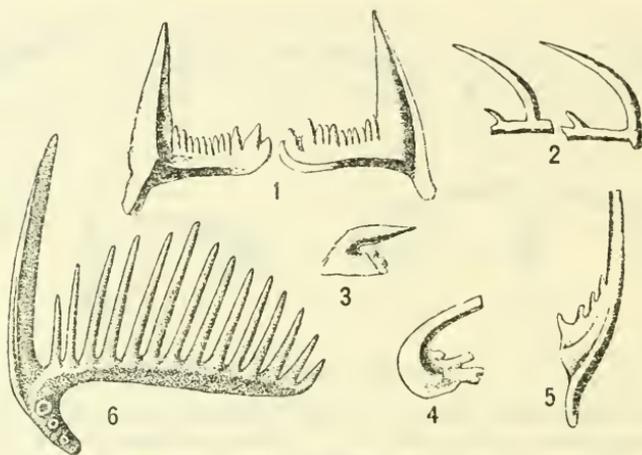


FIG. 3.—PRIONIODIDAE, NEW FAMILY

1. Genus *Prioniodus* Pander, 1856. Left and right teeth of the genotype. *Prioniodus elegans* Pander, 1856. Lower Ordovician of Baltic Provinces.
2. Genus *Subprioniodus* Smith, 1907. Two teeth of the genotype *Subprioniodus paucidentatus* Smith, 1907. Ordovician (Arenig-Llandeilo, Southern Uplands of Scotland).
- 3, 4. Genus *Cordylodus* Pander, 1856. (3) The genotype (first species) *Cordylodus angulatus* Pander, 1856. (4) Tooth of *Cordylodus rotundatus* Pander, 1856, with denticles more developed. Both from Lower Ordovician of Baltic Provinces.
5. Genus *Belodus* Pander, 1856. The genotype (only species) *Belodus gracilis* Pander, 1856. Lower Ordovician of Baltic Provinces.
6. Genus *Ligonodina*, new genus. The genotype *Ligonodina pectinata*, new species. Upper Devonian (Rhinestreet shale of Portage), Shaleton, N. Y.

from a slight development in *Cordylodus* and *Belodus* to the maximum in *Ligonodina*. As in other conodonts, we believe the main cusp is directed backward, making the denticulated bar a posterior development.

Genus PRIONIODUS Pander, 1856

Typically the pick shape is well developed in this genus, the main terminal cusp relatively large with both edges sharp. The basal extension, although variable in length, is usually strong and

often as long as the cusp itself, the anterior line formed by both being nearly straight. Numerous denticles on the bar, their lower half or more sometimes fused, but in some cases, although always closely arranged, they remain discrete to the junction with the bar.

PRIONIODUS PARVIDENTATUS, new species

Plate 9, fig. 1

Terminal main cusp strongly inclined forward with similarly inclined closely approximated small denticles on the horizontal bar. Downward extension similar in shape and size to terminal main cusp.

Occurrence.—Mississippian (Hardin sandstone): Mount Pleasant, Tenn.

Holotype.—Cat. No. 11033, U.S.N.M.

PRIONIODUS SPICATULUS, new species

Plate 9, figs. 2, 3

Differs from *Prioniodus spicatus* Hinde, 1879, of the Upper Devonian of western New York, in having the denticles on the horizontal bar much shorter and apparently of uniform size instead of more or less alternating long and short.

Occurrence.—Mississippian (Hardin sandstone): Mount Pleasant, Tenn.

Cotypes.—Cat. No. 11035 U.S.N.M.

PRIONIODUS CULTRATUS, new species

Plate 9, fig. 7

Distinguished by its flat, broad main cusp at right angles to the bar, apparently short downward extension and denticles on bar of uneven length with the larger near the main cusp and more inclined.

Occurrence.—Mississippian (Hardin sandstone): Mount Pleasant, Tenn.

Holotype.—Cat. No. 11038, U.S.N.M.

PRIONIODUS PROCLINIS, new species

Plate 9, figs. 8-10

Three doubtfully conspecific teeth provisionally referred to this genus of which figure 8 is to be considered as the holotype of the species. All of these are characterized by a rather short form, six or eight rounded well-separated denticles of which the main or terminal cusp is turned decidedly forward and the downward projection is obsolete.

Occurrence.—Mississippian (Hardin sandstone): Mount Pleasant, Tenn.

Holotype and paratypes.—Cat. No. 11031, U.S.N.M.

PRIONIODUS CONCAVUS, new species

Plate 9, fig. 11

Probably closely allied to *P. proclinis* in its denticles but with a more concave base. The terminal denticle is relatively stronger and the smaller denticles are more closely arranged.

Occurrence.—Mississippian (Hardin sandstone): Mount Pleasant, Tenn.

Holotype.—Cat. No. 11036, U.S.N.M.

PRIONIODUS REVERSUS, new species

Plate 9, fig. 4

Similar to *P. parvidentatus* but attitude of denticles and terminal cusp reversed in that they incline backward instead of forward.

Occurrence.—Mississippian (Hardin sandstone): Mount Pleasant, Tenn.

Holotype.—Cat. No. 11037 U.S.N.M.

PRIONIODUS DISPARILIS, new species

Plate 9, fig. 12

In this species the terminal cusp leans forward, is very large, sharp edged with a blunt tip and a rather short downward projection. The bar is nearly straight, slender, slowly tapering, and its upper edge completely occupied by closely arranged, rather short more or less fused denticles nearly at right angles to it.

Occurrence.—Mississippian (Hardin sandstone): Mount Pleasant, Tenn.

Holotype.—Cat. No. 11030, U.S.N.M.

PRIONIODUS INEQUALIS, new species

Plate 9, fig. 6

Founded upon a single specimen characterized by a very long straight terminal cusp strongly inclining forward with short downward projection and short bar with two strong denticles vertical and thus diverging strongly from the main cusp. Bar short possibly incomplete.

Occurrence.—Mississippian (Hardin sandstone): Mount Pleasant, Tenn.

Holotype.—Cat. No. 11034, U.S.N.M.

PRIONIODUS PROCLINATUS, new species

Plate 1, fig. 22

Distinguished from its nearest allies by the great size, straightness and strong anterior inclination of the terminal cusp. The lateral

denticles, six in number, cylindrical, entirely separated, rather short, bluntly acuminate, are fairly strong and inclined in a similar degree. The bar is thin and straight and makes a rectangular junction with the uncommonly thick downward projection of the main cusp.

Occurrence.—Devonian (Rhinestreet): Shaleton, N. Y.

Holotype.—Cat. No. 11240, U.S.N.M.

PRIONIODUS INUTILIS, new species

Plate 1, fig. 23

Similar to *P. proclínatus* but tooth smaller, the denticles including the main cusp rather widely separated and few in number and all more slender and less inclined forward. Downward projection is relatively longer.

Occurrence.—Devonian (Rhinestreet): Shaleton, N. Y.

Holotype.—Cat. No. 11241, U.S.N.M.

PRIONIODUS ALATUS Hinde, 1879

Plate 1, figs. 25, 26

1879. *Prioniodus? alatus* HINDE, Quart. Journ. Geol. Soc. London, vol. 35, p. 361, pl. 16, fig. 5.

In this species the terminal main cusp is enormously developed both in its upward and downward extension, the bar is of moderate strength and in length about a fourth shorter than the combined length of the main cusp and basal projection. The lateral denticles are subequal, about 12 in number, confluent about one-half to three-fourths of their length as though in a sheath with bluntly acuminate terminations beyond it. They decrease quite regularly in length in the posterior half of the bar, the longest having a total length varying between a third and a half of the main cusp. Sides of main cusp are rather sharply ridged, its edges acute and the whole tooth has a somewhat flattened aspect in lateral view. The inclination of the main cusp is constant with respect to the bar and its upward extension varies somewhat in the width of its base as shown in our two views. In those in which the cusp is widest, the sheath also seems to be better developed particularly in its height.

Occurrence.—Devonian (Rhinestreet): Shaleton, N. Y.

Plesiotypes.—Cat. No. 11242, U.S.N.M.

PRIONIODUS CURVIDENS, new species

Plate 1, figs. 16, 17

Main cusp and all the denticles curve slightly toward the front. Main cusp very long, sharp edged and angulated on the side so as to

be rhomboidal in cross section. Downward projection short and thin. Bar of moderate thickness nearly straight, the denticles closely approximated without being in contact, long, slender, 10 or 11 in number, hardly half as long as the main cusp.

At first glance this species seems identical with *Euprioniodina conferta* (see pl. 3, fig. 17) but the complete preparation of the specimens established the entire absence of the denticles on the anterior basal extension in *P. curvidens*.

Occurrence.—Devonian (Rhinstreet); Shaletton, N. Y.

Cotypes.—Cat. No. 11243, U.S.N.M.

PRIONIODUS ARMATUS Hinde, 1879

1879. *Prioniodus armatus* HINDE, Quart. Journ. Geol. Soc. London, vol. 35, p. 360, pl. 15, figs. 20, 21.

We have no specimens corresponding to either of Hinde's figures which if properly drawn, represent two species quite distinct from any herein described. For the present we must assume the figures to be correct and the following four species which are of the same general type of structure are regarded as distinct.

Occurrence.—Devonian (probably Rhinstreet); North Evans, N. Y.

PRIONIODUS UNDOSUS, new species

Plate 1, figs. 18-20

This species belongs to the group in which the main cusp and the lateral denticles incline more or less forward. This particular form differs from the others in having the bar long, very slender, curved downward in the middle and its side with nodelike elevations at the base of each of the lateral denticles. The terminal main cusp is rather strong, nearly straight, longer but not greatly more so than the first three or four denticles behind it. The denticles on the bar are all very slightly curved and decrease rather regularly in length posteriorly. The downward projection is strong and its anterior side makes a straight line with the main cusp.

Occurrence.—Devonian (Rhinstreet); Shaletton, N. Y.

Cotypes.—Cat. No. 11244, U.S.N.M.

LIGONODINA, new genus

General form of tooth as in *Prioniodus* but distinguished by development of a series of suckerlike impressions on one side of the downward extension of the main cusp.

Genotype.—*Ligonodina pectinata*, new species.

Range.—Upper Devonian and Early Mississippian.

In *Ligonodina* the lateral denticles are always rounded and clearly separated from each other and there is no tendency to fusion as in *Prioniodus*. Moreover the bar is always narrower and the main cusp relatively longer, more slender, and, on the side bearing the suckerlike cavities, always shows a sharp ridge on the anterior edge of the main cusp causing a concavity just within it, while the opposite side is regularly rounded. These characters combined give the whole tooth a more delicate appearance. In addition to the new species herein described this new genus includes the following: *L. (Prioniodus) panderi* Hinde, 1879 and *L. (Prioniodus) recedens* Bryant 1921, both from the Upper Devonian of western New York.

LIGONODINA PECTINATA, new species

Plate 2, figs. 9, 10

Main cusp, including the downward extension, at least as long as the bar and arranged at approximately right angles to it. The main specific peculiarity of the species lies in the great length and slenderness of the lateral denticles, of which there are 14 or 15. The denticle next to the main cusp is almost at right angles to the bar and the succeeding ones increase their inclination very slowly to the end of the bar. The bar is sometimes slightly deflected in its terminal fifth.

Occurrence.—Devonian (Rhinestreet): Shaleton, N. Y.

Cotype.—Cat. No. 11245, U.S.N.M.

LIGONODINA PANDERI Hinde, 1879

Plate 2, figs. 1, 2

1879. *Prioniodus panderi* HINDE, Quart. Journ. Geol. Soc. London, vol. 35, p. 361, pl. 16, fig. 4.

Hinde's illustration as interpreted by us indicates a species with an exceedingly strong anterior cusp and relatively delicate bar with widely spaced small though probably long denticles. We have found no exact match in our collection, the nearest approach being the apparently young specimen here figured.

Occurrence.—Devonian (Rhinestreet): Shaleton, N. Y.

Pleisotype.—Cat. No. 11246, U.S.N.M.

LIGONODINA DEFLECTA, new species

Plate 2, figs. 3, 4

This interesting species of which we figure two teeth showing opposite sides, is well characterized by the curvature or deflection of the bar in the posterior half, the relatively few mostly thick

though unequal sized lateral denticles of which there are seven to nine and the thickness of the posterior half of the bar.

Occurrence.—Devonian (Rhinestreet): Shaleton, N. Y.

Cotypes.—Cat. No. 11247, U.S.N.M.

LIGONODINA MAGNIDENS, new species

Plate 2, figs. 5, 6

This species founded upon two teeth showing opposite sides is well characterized by the four middle denticles which are very large almost reaching the size of the main cusp. A pair of much smaller although still relatively long denticles lies on both sides of the larger set.

Occurrence.—Devonian (Rhinestreet): Shaleton, N. Y.

Cotypes.—Cat. No. 11248, U.S.N.M.

LIGONODINA FALCIFORMIS, new species

Plate 2, figs. 11-13

Like *L. pectinata* but the denticles are fewer and more inclined backward to the axis of the bar, the last ones being about at an angle of 50 degrees and most of them distinctly larger. The main cusp also is more curved. The furrow along the anterior edge of the main cusp is narrower and depressed beneath the level of the posterior half. In other species the opposite is the case.

Occurrence.—Devonian (Rhinestreet): Shaleton, N. Y.

Cotypes.—Cat. No. 11249, U.S.N.M.

LIGONODINA HINDEI, new species

Plate 2, figs. 14-16

Characterized by the much greater incurving of both the main cusp with its downward extension and the denticles and the relatively even length and strength of the lateral denticles of which there are seven. The average thickness of the lateral denticles is greater than in any of the other species here recognized. The first five are of more uniform length and size than in any other species.

Occurrence.—Devonian (Rhinestreet): Shaleton, N. Y.

Cotypes.—Cat. No. 11250, U.S.N.M.

LIGONODINA HIBBARDI, new species

Plate 2, figs. 7, 8

Somewhat like *L. hindei* but with a shorter and more delicate bar, fewer (five or six) and more slender denticles and the peculiar straightness of the backwardly directed main cusp. The latter

offers a further perhaps more important difference in the fact that the ridge along the anterior edge is reduced to a minimum.

This fine species is named in honor of Raymond R. Hibbard of Buffalo, N. Y., in appreciation of his enthusiastic work upon the conodonts and bryozoa.

Occurrence.—Devonian (Rhinestreet): Shaleten, N. Y.

Cotypes.—Cat. No. 11251, U.S.N.M.

LIGONODINA SIMPLEX, new species

Plate 9, fig. 28

The anterior end essentially as in other species of the genus except that there are no denticles on the bar, only two suckers on the downward extension of the main cusp and the main cusp more recurved than usual.

Occurrence.—Mississippian (Hardin sandstone): Mount Pleasant, Tenn.

Holotype.—Cat. No. 10983, U.S.N.M.

LIGONODINA TRIDENTATA, new species

Plate 9, fig. 5

Based upon a peculiar apparently perfect tooth which may be variously interpreted. It may consist of a long posteriorly fluted, non-denticulated bar terminating anteriorly in a tridentate main cusp with the denticulated portion entirely in front of the downward projecting sucker bearing extension, or the denticulated portion may be the bar and the long fluted extension may represent the main cusp.

Occurrence.—Mississippian (Hardin sandstone): Mount Pleasant, Tenn.

Holotype.—Cat. No. 11029, U.S.N.M.

PRIONIODINIDAE, new family

Similar to the Prioniodidae but the base of tooth or bar is denticulated both forward and back, the main cusp thus being not terminal but set in the midst of a series of smaller denticles.

To this new family are referred *Cornuramia*, *Valentia* and *Pachysomia* Smith, 1907, *Lonchodus* and *Prionognathus* Pander, 1856, and the following ten new genera: *Prioniodina*, *Euprioniodina*, *Lonchodina*, *Prioniodella*, *Bryantodus*, *Hibbardella*, *Hindeodella*, *Diplododella*, *Palmatodella*, and *Synprioniodina*. *Lonchodus* and *Valentia* are based upon fragments at present generically indeterminate, *Prionognathus* may not prove to be a conodont at all, while nothing like *Cornuramia* or *Pachysomia* has so far been recognized in American strata.

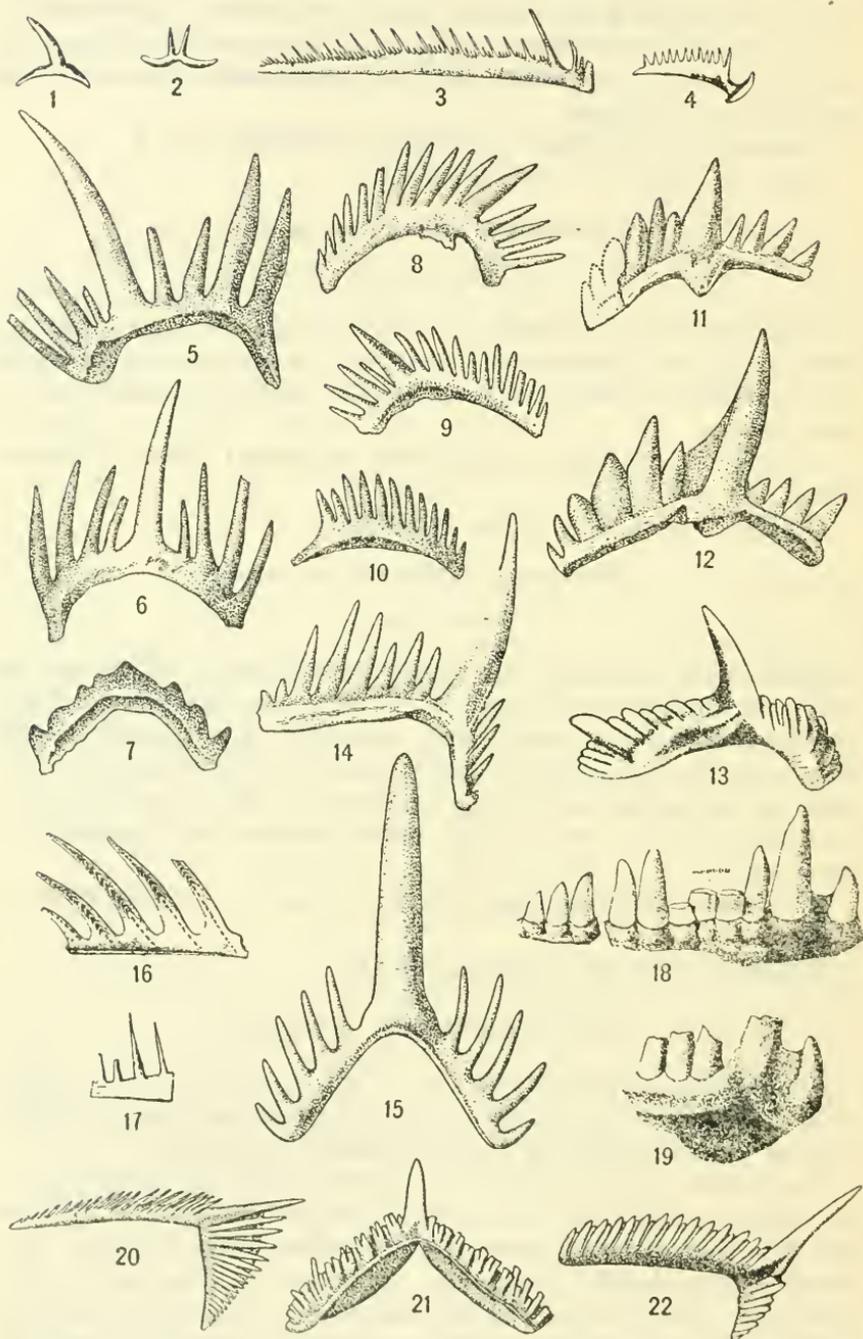


FIG. 4

(See p. 17 for explanation)

FIG. 4.—PRIONIODINIDAE, NEW FAMILY

- 1, 2. Genus *Cornuramia* Smith, 1907. (1) Genotype *Cornuramia monodonta* Smith, 1907. (2) *Cornuramia diplodonta* Smith, 1907. Both from the Ordovician (Arenig-Llandeilo), Ravengill, Scotland.
3. Genus *Hindeodella*, new genus. Genotype *Hindeodella subtilis*, new species, $\times 20$. Base of Mississippian (Hardin sandstone), Mount Pleasant, Tenn.
4. Genus *Pachysomia* Smith, 1907. Genotype *Pachysomia wanlockensis* Smith, 1907. Ordovician (Arenig-Llandeilo), Wanlock Water, Scotland.
- 5-7. Genus *Lonchodina*, new genus. Genotype. *Lonchodina typicalis*, new species. Views of opposite sides of teeth and of the under surface of bar illustrating curvature, $\times 20$. Upper Devonian (Rhinestreet shale of Portage), Shaleton, N. Y.
- 8, 9. Genus *Prioniodina*, new genus. Genotype, *Prioniodina subcurvata*, new species, $\times 20$. Teeth viewed from opposite sides. Upper Devonian (Rhinestreet shale of Portage), Shaleton, N. Y.
10. Genus *Prioniodella*, new genus. Genotype, *Prioniodella normalis*, new species, $\times 20$. Upper Devonian (Rhinestreet shale of Portage), Shaleton, N. Y.
- 11-13. Genus *Bryantodus*, new genus. (11, 12) Genotype, *Bryantodus typicus*, new species, $\times 20$, Upper Devonian (Rhinestreet shale of Portage), Shaleton, N. Y. (13) *Bryantodus nelsoni*, new species, $\times 20$, an aberrant species of the genus. Mississippian (Hardin sandstone at base of Chattanooga shale), Mount Pleasant, Tenn.
14. Genus *Euprioniodina*, new genus. Genotype *Euprioniodina deflecta*, new species, $\times 20$. Upper Devonian (Rhinestreet shale of Portage), Shaleton, N. Y.
15. Genus *Hibbardella*, new genus. Genotype, *Hibbardella angulata* Hinde, 1879, $\times 20$. Upper Devonian (Rhinestreet shale of Portage), Shaleton, N. Y.
16. Genus *Lonchodus* Pander, 1856. (*Centrodus* Pander, 1856, preoccupied.) Genotype, *Lonchodus* (*Centrodus*) *simplex* Pander, 1856. Carboniferous of Russia.
17. Genus *Valentia* Smith, 1907. Genotype, *Valentia morrochensis* Smith, 1907. Ordovician (Arenig-Llandeilo), Morroch Bay, Scotland.
- 18-19. Genus *Prionognathus* Pander, 1856. Views of opposite sides of the genotype *Prionognathus brandtii* Pander, 1856. Silurian, Island of Oesel. Probably not a conodont.
20. Genus *Palmatodella* new genus. Genotype, *Palmatodella delicatula*, new species, $\times 20$. Mississippian (Chattanooga shale), 13 miles east of north of Huntsville, Ala.
21. Genus *Diplododella*, new genus. Genotype, *Diplododella bilateralis*, new species, $\times 20$. Mississippian (Chattanooga shale), 13 miles east of north of Huntsville, Ala.
22. Genus *Synprioniodina*, new genus. *Synprioniodina alternata*, new species, $\times 20$. Mississippian (Chattanooga shale), 13 miles east of north of Huntsville, Ala.

PRIONIODINA, new genus

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*, new species.

Range.—Upper Devonian, Early Mississippian.

To this new genus the following previously described species are referred *Prioniodus geminus* Hinde, 1900, *P. recedens* Bryant, 1921 and *P. volborthii* Pander, 1856.

PRIONIODINA SUBCURVATA, new species

Plate 4, figs. 22, 23, 24

Tooth consisting of a strongly curved bar surmounted by about 18 denticles, all of which are of subequal size and uniformly separated except the fourth or fifth from the shorter end, regarded as the main cusp, which occupies nearly the space of two others and projects to a moderate extent beyond their tips.

Occurrence.—Devonian (Rhinestreet shale): Shaletton, N. Y.

Cotypes.—Cat. No. 11252, U.S.N.M.

PRIONIODINA SEPARATA, new species

Plate 4, figs. 17, 18

Like *P. subcurvata* but the main cusp is more median in position and relatively smaller, the denticles are more slender, less tapering, and their bases more widely expanded. Moreover the bar is less curved.

Occurrence.—Devonian (Rhinestreet): Shaletton, N. Y.

Cotypes.—Cat. No. 11253, U.S.N.M.

PRIONIODELLA, new genus

Like *Prioniodina* except that the denticles are subequal, none being particularly larger than the other.

One end of the bar supposed to be the posterior because of the slant of the denticles, is commonly produced into a blunt process. The denticles are always close, either discrete throughout or more or less coalescent, agreeing in the latter feature with *Bryantodus*. The lack of a readily distinguishable main cusp separates this genus from both *Prioniodina* and *Bryantodus*.

Genotype.—*Prioniodella normalis*, new species.

Range.—Upper Devonian, Early Mississippian.

In addition to the species here described, *Centrodus invalidus* Bryant apparently belongs to this genus.

PRIONIODELLA NORMALIS, new species

Plate 4, figs. 1, 1'

The moderately curved bar, relatively strongly produced posteriorly, bearing 12 or 13 denticles with the strongest in the posterior half, from which point they diminish in strength although not greatly in length to the anterior extremity, is characteristic of this species. The denticles are compressed rounded, closely arranged, but remain separated practically to their bases.

Occurrence.—Devonian (Rhinestreet): Shaleton, N. Y.

Holotype.—Cat. No. 11254, U.S.N.M.

PRIONIODELLA INAEQUALIS, new species

Plate 4, figs. 2, 3

General shape as in *P. normalis*, except that the posterior extremity terminates more bluntly and the denticles are flatter, coalesced, and very unequal and irregular in size. The anterior denticles are shorter and those of the middle half have an average size much greater both in width and height than those in the terminal quarter.

Occurrence.—Devonian (Rhinestreet): Shaleton, N. Y.

Cotypes.—Cat. No. 11255, U.S.N.M.

PRIONIODELLA AEQUIDENS, new species

Plate 4, figs. 6, 7

Similar to *P. normalis* but bar is more curved, apparently without a distinct posterior projection, with numerous subequal and very closely approximated, largely confluent denticles.

Occurrence.—Devonian (Rhinestreet); Shaleton, N. Y.

Holotype.—Cat. No. 11256, U.S.N.M.

PRIONIODELLA MULTIDENS, new species

Plate 4, figs. 4, 5

Based upon a very small tooth the bar of which is relatively wide, the denticles very small, numerous (21 or 22) relatively very short and of approximately the same size except that a few may be wider although not otherwise distinguishable. Although very close together, the denticles seem to be separated from each other.

Occurrence.—Devonian (Rhinestreet): Shaleton, N. Y.

Holotype.—Cat. No. 11257, U.S.N.M.

PRIONIODELLA INFORMATA, new species

Plate 10, figs. 19, 20

Tooth slightly bowed with basal outline almost straight, slender spinelike denticles on upper side increasing in length from either side to the middle. Denticles separated by a little more than their own width and occasionally a small denticle between each pair of larger ones. One end of bar somewhat rounded.

Occurrence.—Mississippian (Hardin sandstone): Mount Pleasant, Tenn.

Cotypes.—Cat. No. 10991, U.S.N.M.

PRIONIODELLA BREVISPINA, new species

Plate 10, fig. 21

Characterized by the thick bar, relatively short length with one end (presumably anterior) much wider and blunter than the other, and subequal size of denticles with every third and fourth one slightly larger. In all, fifteen denticles with one or two at either end shorter and much smaller than all the others.

Occurrence.—Mississippian (Hardin sandstone): Mount Pleasant, Tenn.

Holotype.—Cat. No. 10993, U.S.N.M.

PRIONIODELLA GRACILIS, new species

Plate 10, figs. 22, 23

Bar rather slender, of moderate length with a short spinelike downward projection at its wider end. Upper side crowned with about 9 long, slender, separated denticles with a moderate backward inclination.

Occurrence.—Mississippian (Hardin sandstone): Mount Pleasant, Tenn.

Cotypes.—Cat. No. 10992, U.S.N.M.

PRIONIODELLA ROBUSTA, new species

Plate 10, fig. 24

Distinguished from *P. gracilis* by its stronger and quite erect denticles. The species also shows no sign of the anterior spurlike downward projection.

Occurrence.—Mississippian (Hardin sandstone): Mount Pleasant, Tenn.

Holotype.—Cat. No. 10990, U.S.N.M.

PRIONIODELLA CONFERTA, new species

Plate 10, fig. 25

Especially distinguished from other species of this genus by its strong, closely approximated denticles set obliquely to the bar. The lower half of the denticles is concave and seems to be set into a transversely striated, outwardly concave sheath, therein suggesting the confluent denticles characterizing *Bryantodus*. However, none of the denticles can be distinguished as the main cusp which is always strongly indicated in *Bryantodus*.

Occurrence.—Mississippian (Hardin sandstone): Mount Pleasant, Tenn.

Holotype.—Cat. No. 10989, U.S.N.M.

BRYANTODUS, new genus

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*.

Genotype.—*Bryantodus typicus*, new species.

This new generic name is in recognition of the studies upon fossil fishes by W. L. Bryant, director of the Park Museum, Providence, R. I.

Range.—Upper Devonian and Early Mississippian.

Of previously described species, *Prioniodus cristatus*, *P. macrodentatus*, *P. obtusus*, *P. parvulus*, *P. parvus*, *P. retusus*, and *P. spatulatus* Bryant, 1921, *Polygnathus dubius* Smith, 1907, *Polygnathus duplicatus* *P. immersus* and *P. radiatus* Hinde, 1879, and *Prioniodus politus* Hinde, 1879, belong to *Bryantodus*.

BRYANTODUS TYPICUS, new species

Plate 6, figs. 11, 12

Bar slightly curved, with an accentuated downward turn at the anterior extremity, surmounted by 10 relatively short, flat, confluent denticles setting well back from the flange-like expansion of the bar. Main cusp strong, nearly three times as wide at the base as any other denticle, slightly recurved toward its top, with thin, sharp edges, the latter appearing on the inner side of tooth like a mem-

branous connection with the denticle behind it. Usually five short, broad, confluent denticles, with spear-like terminations posterior to the main cusp and four less confluent and more elongate conical denticles on the anterior side. Downward projection of bar below main cusp well developed. Of the posterior denticles, the second and third from the main cusp are wider than the others, the last two being quite small.

Occurrence.—Devonian (Rhinestreet): Shaletton, N. Y.

Cotype.—Cat. No. 11258, U.S.N.M.

BRYANTODUS? TRIDENTATUS, new species

Plate 6, fig. 13

Easily recognized in that the tooth consists of three broad based, thin edged denticles gradually increasing in size to the largest which is regarded as the main cusp and by the complete absence of the bar and denticles posterior to this. There is no indication that the absence of the posterior part is due to imperfection of the specimen. The species is only provisionally referred here pending the discovery of other forms of similar nature.

Occurrence.—Devonian (Rhinestreet): Shaletton, N. Y.

Holotype.—Cat. No. 11259, U.S.N.M.

BRYANTODUS? INEQUALIS, new species

Plate 6, fig. 14

Readily distinguished by the extreme difference between the size of the lateral series of denticles and the main cusp. The lateral series of denticles are all fused but those on the shorter (anterior?) side five in number merging into the base of the main cusp, are much smaller and seem almost a part of it while seven making the longer series are more definitely separated although also with confluent edges.

This species seems to be an aberrant type with possible prophetic relations to the Mississippian genus *Palmatodella*.

Occurrence.—Devonian (Rhinestreet): Shaletton, N. Y.

Holotype.—Cat. No. 11260, U.S.N.M.

BRYANTODUS MULTIDENS, new species

Plate 6, figs. 15, 16

Our figures are of two teeth showing opposite sides, the inner (15) and the outer (16), and illustrate differences to be noticed in such views. The tooth is longer with respect to the height than in any other species. The denticles are developed normally for this

genus but those on the two sides of the main cusp are bilaterally much more equal in size and more numerous than in other species, there being at least ten on each side. The main cusp is very broad and the membrane-like connection with the contiguous denticles is mainly shown in the outer side. Further the main cusp is shorter and projects less beyond the tips of the lateral denticles than in any of the other species.

Occurrence.—Devonian (Rhinestreet): Shaleton, N. Y.

Cotypes.—Cat. No. 11261, U.S.N.M.

BRYANTODUS CRASSIDENS, new species

Plate 6, figs. 17, 18

Similar to *B. typicus* but differs in its more regular curvature and more uniform development of the denticles, giving them a neater aspect on the whole. The basal part of the main cusp is thicker on both sides but especially on the inner side where the membranelike connection with the adjacent denticles is much less evident. The species differs from most others in the great thickness of the denticles near the base and their relative shortness and their greater length and also straighter extremities. The denticles are also fewer than usual with seven or eight behind the main cusp gradually diminishing posteriorly and usually four anteriorly increasing in front of it.

Occurrence.—Devonian (Rhinestreet): Shaleton, N. Y.

Cotypes.—Cat. No. 11263, U.S.N.M.

BRYANTODUS OBLIQUUS, new species

Plate 6, figs. 19–21

Distinguished from *B. crassidens* in having somewhat longer denticles more curved in an anterior direction and particularly in that the ones in front of the main cusp decrease in size anteriorly instead of the reverse.

Occurrence.—Devonian (Rhinestreet): Shaleton, N. Y.

Cotypes.—Cat. No. 11264, U.S.N.M.

BRYANTODUS SINUATUS, new species

Plate, 6, figs. 22–24

Evidently a close ally of *B. obliquus* from which it differs particularly in the straighter bar, more sinuate base and the decided projection of the portion beneath the main cusp, the latter feature causing the appearance of a shallow sinus on each side; also in the narrower and more cylindrical section of the denticles with longer and more acuminate terminations. The main cusp is also longer than in that species and not so wide. Other difference may be noted

on comparison of the figures. One of the specimens shows minute fluting on the underside of the bar.

Occurrence.—Devonian (Rhinestreet): Shaleton, N. Y.

Cotypes.—Cat. No. 11265, U.S.N.M.

BRYANTODUS NITIDUS, new species

Plate 4, figs. 12-14

This neat species as based upon Figures 12 and 13 is characterized by the rather strong even curvature of the bar, prominence although not great size of the main cusp, numerous, subequal, outwardly diminishing denticles all inclined toward the posterior end and the small size of the protuberance on the under side of the bar immediately beneath the main cusp. Both specimens have 13 denticles behind and about 10 in front of the main cusp. Figure 14 represents a specimen referred here with doubt for reasons apparent upon inspection of the photograph. This species belongs to a group better developed in the Mississippian black shales.

Occurrence.—Devonian (Rhinestreet): Shaleton, N. Y.

Cotypes.—Cat. No. 11266, U.S.N.M.

BRYANTODUS CONJUNCTUS, new species

Plate 4, figs. 8, 9

Curvature of bar uncommonly strong. Main cusp of moderate size, sharp edged but apparently terminating bluntly, with 10 or 11 flat, convex coalescent denticles on each side.

The strong curvature of the bar and the rather short and not large main cusp with an equal number of numerous denticles on each side will sufficiently distinguish this species which, however, is not to be counted as a typical species of the genus.

Occurrence.—Devonian (Rhinestreet): Shaleton, N. Y.

Cotypes.—Cat. No. 11267, U.S.N.M.

BRYANTODUS SEMISEPARATUS, new species

Plate 4, fig. 1C

Bar rather strongly curved, main cusp slender, very long coalescing with the shorter denticle immediately in front, and this with all the others to the anterior extremity. Posterior denticles long, slender, seven in number, and all separate.

Occurrence.—Devonian (Rhinestreet): Shaleton, N. Y.

Holotype.—Cat. No. 11268, U.S.N.M.

BRYANTODUS NORMALIS, new species

Plate 4, figs. 25, 26, and 27

Allied to *B. crassidens*, *B. obliquus*, and *B. sinuatus* but more particularly to the first from which it differs in having both the lateral

series of denticles relatively smaller, the disproportion in size being especially apparent in those close to the base of the main cusp. It differs from the other two mentioned in the straightness and somewhat broader base of the main cusp.

Occurrence.—Devonian (Rhinestreet): Shaleton, N. Y.

Cotypes.—Cat. No. 11269, U.S.N.M.

BRYANTODUS COALESCENS, new species

Plate 4, fig. 28

Distinguished from all others by the merging of four or five denticles adjacent to the main cusp so that it gives the appearance of an enormously broad, rapidly tapering triangular main cusp. The base is rather strongly curved, especially at the outer extremity of the long end which is also uncommonly long as compared to the posterior part. The latter carries three or four slightly projecting, posteriorly diminishing, coalescent denticles. In the anterior end there are five thick anteriorly diminishing denticles beyond those merged into the base of the main cusp, the first being the largest.

Occurrence.—Devonian (Rhinestreet): Shaleton, N. Y.

Holotype.—Cat. No. 11270, U.S.N.M.

BRYANTODUS INSOLENS, new species

Plate 10, fig. 17

Tooth rather slender, the shorter end incurved and its extremity rounded upward, with the median cusp large, prominent, and truncated bluntly, with 5 or 6 denticles on one side (anterior) and 12 or more on the other, all denticles closely arranged.

This new species is similar to *B. nelsoni* and with it forms a section of the genus that in the shape of its anterior end has a resemblance to *Hindeodella*.

Occurrence.—Mississippian (Hardin sandstone): Mount Pleasant, Tenn.

Holotype.—Cat. No. 11015, U.S.N.M.

BRYANTODUS GERMANUS, new species

Plate 10, fig. 18

Related to *B. subradiatus* but with a more expanded base, having small wart-like elevations on its upper surface. The denticulated part is distinguished by the spatulate form of the main cusp and the great inequality in the denticles on opposite sides of it.

Occurrence.—Mississippian (Hardin sandstone): Mount Pleasant, Tenn.

Holotype.—Cat. No. 11016 U.S.N.M.

BRYANTODUS TENUIS, new species

Plate 10, fig. 7

This differs from all other species of the genus in the narrowness of the bar and the minute denticles which are closely arranged on one half and farther apart on the other. The main cusp is distinguishable but not conspicuously different from the separated denticles.

Occurrence.—Mississippian (Hardin sandstone): Mount Pleasant, Tenn.

Holotype.—Cat. No. 11025 U.S.N.M.

BRYANTODUS TRANSITANS, new species

Plate 4, figs. 10, 11

This species has a general resemblance in the curvature of the bar, and size and arrangement of the denticles to *Prioniodella aequidens* but it is readily distinguished by the development of one of the median denticles as a main cusp with flattened edges: which fuse somewhat with neighboring denticles.

Occurrence.—Devonian (Rhinestreet): Shaleton, N. Y.

Cotype.—Cat. No. 11262, U.S.N.M.

BRYANTODUS CURVATUS, new species

Plate 4, figs. 19, 20

This species is intermediate in its characters between *Prioniodina* and *Bryantodus*, the complete separation of the denticles being as in the former and the sharp lateral edges of the main cusp as in the latter. It may be viewed as a further step in the transition between the two genera from that seen in *Bryantodus semiseparatus* in which fusion of the posterior denticles still occurs. *Prioniodina subcurvata* has a similar form but has a rounded main cusp.

Occurrence.—Devonian (Rhinestreet): Shaleton, N. Y.

Cotype.—Cat. No. 11271, U.S.N.M.

BRYANTODUS SUBRADIATUS, new species

Plate 10, figs. 12, 13

Similar to *B. radiatus* Hinde, 1879, from the Genesee shale of western New York but differs in the much smaller size of the main cusp, in the more uniform size of the denticles and in lacking the protuberance beneath the main cusp.

Occurrence.—Mississippian (Hardin sandstone): Mount Pleasant, Tenn.

Cotypes.—Cat. No. 11022, U.S.N.M.

BRYANTODUS MINUTUS, new species

Plate 10, fig. 6

Characterized by the relatively very large size of the sharp edged main cusp and inconspicuous development of the denticles on the two sides of the base. On the thicker end of the bar there are three more or less confluent denticles, likewise three but more or less separated ones on the smaller end. The chief characteristic of this species besides its minute size, is the great disparity in the size of the denticles and the main cusp.

Occurrence.—Mississippian (Hardin sandstone): Mount Pleasant, Tenn.

Holotype.—Cat. No. 11018, U.S.N.M.

BRYANTODUS CRASSUS, new species

Plate 10, fig. 14

Founded on a broken tooth which differs from others in the greater strength of its bar with a distinct knob beneath the median cusp which latter is larger and peculiarly directed. The lateral denticles are rather small.

Occurrence.—Mississippian (Hardin sandstone): Mount Pleasant, Tenn.

Holotype.—Cat. No. 11026, U.S.N.M.

BRYANTODUS GRACILIS, new species

Plate 10, fig. 10

Similar to *B. subradiatus* but tooth on the whole more slender, denticles smaller and more numerous and main cusp relatively much thicker and probably longer.

Occurrence.—Mississippian (Hardin sandstone): Mount Pleasant, Tenn.

Holotype.—Cat. No. 11021, U.S.N.M.

BRYANTODUS PERGRACILIS, new species

Plate 10, fig. 11

More slender than *B. gracilis*, whole tooth straighter and lateral denticles more uniform in size at the two ends of bar.

Occurrence.—Mississippian (Hardin sandstone): Mount Pleasant, Tenn.

Holotype.—Cat. No. 11023, U.S.N.M.

BRYANTODUS INCERTUS, new species

Plate 10, fig. 8

Founded upon the inner side of a nearly complete tooth distinguished from all others of this genus by its broadly curved form

and its enormous sharp-edged median cusp, the base of which lies toward the inner side of the bar. The denticles on the two ends of the bar are set farther forward toward the outside of the bar. All of these are, as usual in the genus, sharp edged and in part confluent with five rather short broad-based denticles on the shorter end and five similar but larger and longer denticles occupying the outer two-thirds of the longer ends of the bar. Finally, four or five minute denticles are between the latter and the base of the main cusp.

Occurrence.—Mississippian (Hardin sandstone): Mount Pleasant, Tenn.

Holotype.—Cat. No. 11019, U.S.N.M.

BRYANTODUS NELSONI, new species

Plate 10, fig. 9

Bar rather thick, slightly curved, the anterior half curved downward and inward with numerous laterally confluent denticles (9-12). Main cusp large, thick, very prominent bent somewhat backward. Posterior end of bar with large, less curved although otherwise similar denticles as on anterior end.

This species, as well as *Bryantodus insolens*, belongs to a peculiar group of the genus suggesting in the form of the part in front of the main cusp the corresponding part of *Hindeodella*.

Occurrence.—Mississippian (Hardin sandstone): Mount Pleasant, Tenn.

Holotype.—Cat. No. 11020, U.S.N.M.

BRYANTODUS SUBBREVIS, new species

Plate 10, fig. 15, 16

Our figures represent opposite teeth of this new species showing the short form slight curvature of base, semiovate outline and decidedly recurved denticles which distinguish it from *B. radiatus* and its allies.

Occurrence.—Mississippian (Hardin sandstone): Mount Pleasant, Tenn.

Cotypes.—Cat. No. 11027, U.S.N.M.

BRYANTODUS CURVATULUS, new species

Plate 9, fig. 13

Tooth curved tapering rapidly backward, the anterior end unknown, broken. The posterior denticles about 10 compactly arranged, inclining forward, subequal in size, the main cusp not greatly longer but considerably wider than the others.

Occurrence.—Mississippian (Hardin sandstone): Mount Pleasant, Tenn.

Holotype.—Cat. No. 11032, U.S.N.M.

EUPRIONIODINA, new genus

Like *Prionodina* but main cusp much more produced and interior part of bar, smaller, shorter, more sharply deflected and carrying on its upper edge a series of closely arranged denticles.

Genotype.—*E. deflecta*, new species.

Range.—Upper Devonian, Mississippian.

Because of the denticulated anterior part of the bar this genus falls in the Prioniodinidae but the general aspect is that of a *Prioniodus* with the downward projection of the main cusp bearing denticles. If not properly prepared, specimens are liable to be confused with *Prioniodus*. *Prioniodus acicularis*, *P. furcatus*, and *P. radicans* Hinde, 1879, *P. alatus*, and *P. discedens* Hadding, 1913, and *P. lanceolatus* and *P. curvatus* Smith, 1907, appear to belong to this genus judging from their illustrations.

EUPRIONIODINA DEFLECTA, new species

Plate 3, figs. 11, 12

Tooth with the main cusp and posterior extension of bar having the general aspect of *Prioniodus* but the anterior downward projection is not simple, as it carries three or four small denticles. Main cusp slightly curved posteriorly, although on the whole inclining forward. Posterior extension of bar with eight somewhat unequal but fairly stout denticles, the largest of which may be approximately half the length of the main cusp. Downward projection of bar about rectangular to the axis of the bar and about half as long.

Occurrence.—Devonian (Rhinestreet): Shaleton, N. Y.

Cotypes.—Cat. No. 11272, N.S.N.M.

EUPRIONIODINA CONFERTA, new species

Plate 3, fig. 17

Distinguished by the considerable width, unusual flatness, sharp edges and decided anterior curving of the main cusp and the more closely arranged posterior lateral denticles which are twelve in number. Anterior denticles three, small and short. The downward extension is relatively small and directed somewhat anteriorly making an angle of about 110 degrees.

Occurrence.—Devonian (Rhinestreet): Shaleton, N. Y.

Holotype.—Cat. No. 11273, U.S.N.M.

EUPRIONIODINA BRYANTI, new species

Plate 3, figs. 13, 14; Plate 1, fig. 21

Similar to *E. deflecta* but both main cusp and denticles are on the whole more slender, farther apart and the largest of the latter relatively longer reaching almost two thirds the length of the main

cusps. Base of the main cusp considerably narrower and set a little lower with respect to the top of the bar and at once turns upward. In specimens of the same size, the posterior bar is wide. The anterior downward projection bends further posteriorly, making less of a right angle with the bar while in *E. deflecta* this angle is 5 to 10 degrees more than a right angle. Also the whole posterior part of the bar is slightly but distinctly arcuate.

Occurrence.—Devonian (Rhinestreet): Shaleton, N. Y.

Cotypes.—Cat. No. 11274, U.S.N.M.

EUPRIONIODINA PERANGULATA, new species

Plate 3, fig. 10

Tooth developed almost equilaterally as in *Hibbardella* but when carefully examined it is found that the two lateral extensions are not equal the anterior one being the longer of the two and carrying six short, blunt (possibly evenly broken) closely spaced denticles whereas the other end of the bar carries four with a minute one between the first and the second, much longer, well separated straight denticles. Moreover the main cusp is very slightly curved. All of these characters suggest *Euprioniodina* and compared with other species of this genus this one is readily recognized by its sharp angulation and the reversal in length of the lateral extensions of the bar.

Occurrence.—Devonian (Rhinestreet): Shaleton, N. Y.

Holotypes.—Cat. No. 11275, U.S.N.M.

EUPRIONIODINA PECULIARIS, new species

Plate 10, fig 3

Founded upon a single practically complete specimen showing the inner side of tooth. It consists of a rather thin, basally excavated, strongly bent plate carrying on the upper surface of the posterior half a series of strong bluntly tapering denticles all more or less backwardly inclined and terminating near the middle of the whole tooth in a cusp which is much larger than the others. In front of this is a space without denticles and then a series of about seven denticles much smaller than those on the posterior half.

Occurrence.—Mississippian (Hardin sandstone): Mount Pleasant, Tenn.

Holotype.—Cat. No. 11017, U.S.N.M.

LONCHODINA, new genus

Like *Euprioniodina* but ends of bar more equal in length and the entire bar strongly bowed, bent in two directions one with the usual upward curvature at the middle and the other outwardly as seen in

a view of the underside of the base; denticles more irregular and farther separated. Main cusp sometimes not readily distinguished from the denticles.

The main characteristics of this genus are its outwardly bowed form, the greater length and separation of the rounded needle-shaped denticles, and their usually unsymmetrical arrangement. The bowing of the tooth is especially characteristic, this occurring in two directions, upward and outward.

Genotype.—*L. typicalis*, new species.

Range.—Upper Devonian and Early Mississippian.

LONCHODINA TYPICALIS, new species

Plate 5, figs. 1, 2

The curved and outwardly bowed bar is thin and carries on its upper edge first a strong median cusp and on each side of this four or five denticles outwardly increasing in length and thickness, the first denticles being small and the others becoming two-thirds the size of the main cusp. Ends of bar curved down but the anterior end is longer and more downward projecting than the others. Lateral denticles require more and more of a curve to assume the erect position characteristic of their upper half.

This species is especially characterized by the nearly equilateral development of the denticles on each side of the main cusp, their strength, erect habits of their tips, and their curvature increasing successively away from the median cusp.

Occurrence.—Devonian (Rhinestreet): Shaleton, N. Y.

Cotypes.—Cat. No. 11276, U.S.N.M.

LONCHODINA SEPARATA, new species

Plate 5, fig. 12

In separation and relative uniform size of denticles allied to *L. delicatula* but tooth on the whole shorter with fewer denticles on each side of the main cusp and especially on the posterior side (four on the anterior and only two or possibly three on the posterior side). Also in that the denticles of the anterior half decrease rather regularly in length outwardly whereas in *L. delicatula* they increase in this direction.

Occurrence.—Devonian (Rhinestreet): Shaleton, N. Y.

Holotype.—Cat. No. 11277, U.S.N.M.

LONCHODINA RECTIDENS, new species

Plate 5, figs. 13, 14

Bar short, strongly curved and bowed, bearing long straight diverging, closely arranged denticles with four rather small ones on

one end of equal size and three or four of larger though irregular sizes in middle part of tooth and two relatively small ones on the other end. It is difficult to pick out the main cusp.

Occurrence.—Devonian (Rhinestreet): Shaleton, N. Y.

Cotypes.—Cat. No. 11278, U.S.N.M.

LONCHODINA ARCUATA, new species

Plate 5, fig. 15

Bar strongly arcuate, curved so that the extremities are at approximately right angles, bearing an anterior series of denticles all curving inward, the others beginning with the main cusp, straight and excepting the one nearest the main cusp diminishing outwardly in size. These characteristics especially the arcuate bar, readily distinguish this species.

Occurrence.—Devonian (Rhinestreet): Shaleton, N. Y.

Holotype.—Cat. No. 11279, U.S.N.M.

LONCHODINA BILATERALIS, new species

Plate 5, fig. 18

Bar with subequally down-curved extremities, crowned by 11 straight diverging denticles of which 2 are very large and nearly equal in size, 3 outwardly diminishing denticles on one side, 2 or 3 between the large pair and 4 much smaller ones on the other end. Except the last, which are also slender, all the other teeth are thick, joined below and taper rapidly toward their extremities.

Occurrence.—Devonian (Rhinestreet): Shaleton, N. Y.

Holotype.—Cat. No. 11280, U.S.N.M.

LONCHODINA PERLONGA, new species

Plate 5, figs. 6, 7

Similar to the genotype *L. typicalis*, but all the denticles are more slender, relatively longer, with one or two more on either side of the median cusp. All the denticles are slightly curved and divergent toward their tips. Moreover, they are closer together, although remaining separate to the bar.

Occurrence.—Devonian (Rhinestreet): Shaleton, N. Y.

Holotype.—Cat. No. 11280, U.S.N.M.

LONCHODINA SUBANGULATA, new species

Plate 5, fig. 3

Similar to *L. perlonga* except that the bar is angulated, the denticles are closer together, and the main cusp, though little curved,

bends backward so strongly that it is almost parallel with the direction of the anterior half of the bar. Five or six denticles on the anterior part of the bar, all curved backward. On the posterior side of the main cusp eight or possibly nine denticles all straight, relatively equal in size and length and paralleling in direction the main cusp.

Occurrence.—Devonian (Rhinestreet): Shaleton, N. Y.

Holotype.—Cat. No. 11282, U.S.N.M.

LONCHODINA SUBRECTA, new species

Plate 5, figs. 4, 5

Distinguished from *L. typicalis* by its much less bilateral development and less regular arrangement of the denticles. The outer denticles are much smaller than the inner ones and throughout are very little curved so that their tips diverge with respect to the median cusp. Two of the anterior denticles flanked by one or two smaller denticles and the main cusp with two small denticles on the other end approach the main cusp in size, whereas the posterior series consists of four much smaller and nearly equal denticles, thus causing the lack of bilaterality.

Occurrence.—Devonian (Rhinestreet): Shaleton, N. Y.

Cotypes.—Cat. No. 11283, U.S.N.M.

LONCHODINA DELICATULA, new species

Plate 5, fig. 11

Curvature of bar about as in *L. typicalis*, which it resembles in general and from which it differs as it does from all other species of the genus here recognized in the exceeding slenderness and wide separation of the denticles. The main cusp shares in this slenderness and is moreover somewhat sharp edged. The denticles are more nearly of a uniform size than any of the species to which it is allied.

Occurrence.—Devonian (Rhinestreet): Shaleton, N. Y.

Holotype.—Cat. No. 11284, U.S.N.M.

LONCHODINA PERARCUATA, new species

Plate 5, fig. 19

Bar horseshoe shaped, the anterior half with about nine rather rapidly tapering curved denticles. The main cusp in the middle of the curved bar, a small denticle next, succeeded by two nearly equaling the main cusp in size and finally by two very small ones.

The outstanding characteristic of this species is the exceeding curvature of the bar. In other respects it reminds of *L. bilateralis*

and *L. rectidens*, but not sufficiently to render confusion with them at all likely.

Occurrence.—Devonian (Rhinestreet): Shaleton, N. Y.

Holotype.—Cat. No. 11285, U.S.N.M.

LONCHODINA PAUCIDENS, new species

Plate 6, fig. 1

This species is founded on an exceedingly delicate tooth, distinguished from all others by its curved bar and very few subequal slender, straggly denticles. Its nearest relatives probably are *L. subangulata*, *L. separata*, and *L. projecta*, but in each case the differences are such that detailed comparisons seem unnecessary.

Occurrence.—Devonian (Rhinestreet): Shaleton, N. Y.

Holotype.—Cat. No. 11286, U.S.N.M.

LONCHODINA SUBSYMMETRICA, new species

Plate 6, figs. 5, 6, 7; plate 5, fig. 8; and plate 1, fig. 24

Like *L. perlonga*, but all the denticles are shorter, and the main cusp is not only shorter but much stronger in its lower half and is situated on the posterior side instead of the anterior. There are thus only five denticles behind the main cusp and usually seven in front of it, instead of nine behind and five in front, as in *L. perlonga*.

Occurrence.—Devonian (Rhinestreet): Shaleton, N. Y.

Cotypes.—Cat. No. 11287, U.S.N.M.

LONCHODINA ABNORMIS, new species

Plate 6, figs. 8–10

Readily distinguished from all the associated forms by its relatively short, basally nearly straight, and medially thick bar, with few denticles on each side of a large, moderately recurved cusp. Usually three denticles in front of the main cusp and one at its base, which shows only on the inner side, and two behind the main cusp.

Occurrence.—Devonian (Rhinestreet): Shaleton, N. Y.

Cotypes.—Cat. No. 11288, U.S.N.M.

LONCHODINA TRANSVERSA, new species

Plate 6, figs. 2, 3

In this species the bar is uncommonly long and straight and the denticles show practically no curvature. The species reminds of *Hibbardella* but the main cusp is not in the middle nor directly over the swelling in the bar as in that genus. The main cusp is

long cylindrical slightly flattened at the rapidly tapering extremity. Six to nine denticles on the longer end of bar and usually four on the shorter, cylindrical and their bases separated by fully their own diameter. The relative straightness of the bar readily characterizes this species which in no other respects is much like *L. perlonga* although the denticles are shorter throughout.

Occurrence.—Devonian (Rhinestreet): Shaleton, N. Y.

Cotypes.—Cat. No. 11289, U.S.N.M.

LONCHODINA ALTERNATA, new species

Plate 6, fig. 4

Similar in angulation of the bar to *L. arcuata* and *L. subangulata* but readily distinguished from both of them by the very unequal, alternating size of the denticles on the posterior part. There are minor differences in the trend of the curvature of the main cusp and other points which are brought out in the illustration.

Occurrence.—Devonian (Rhinestreet): Shaleton, N. Y.

Holotype.—Cat. No. 11290, U.S.N.M.

LONCHODINA? INCREBESCENS, new species

Plate 5, fig. 20; Plate 3, figs. 15, 16

Tooth strongly bowed outward but the distinct separation of the main cusp and its strong denticulated downward projection (anterior end of bar) suggests *Euprioniodina*. The very considerable strength of the denticles on both ends of the bar decided the provisional placement under *Lonchodina*. On account of the bowed form the tooth is usually broken but unless broken so that the two ends of bar separate and lie more nearly in a plane than natural the denticles of the anterior end are not visible in a view of the convex side.

Occurrence.—Devonian (Rhinestreet): Shaleton, N. Y.

Cotypes.—Cat. No. 11291, U.S.N.M.

LONCHODINA? PROJECTA, new species

Plate 5, figs. 9, 10

The main cusp and anterior set of denticles are similar to *L. subangulata* except that all of the denticles are relatively larger and somewhat farther apart and the main cusp is flatter with a suggestion of sharp edges. The main difference lies in the uncommon brevity of the posterior end which is about half as long as the anterior and carries only two or three subequal denticles.

Occurrence.—Devonian (Rhinestreet): Shaleton, N. Y.

Cotypes.—Cat. No. 11292, U.S.N.M.

LONCHODINA? PRONA, new species

Plate 5, figs. 16, 17

Like *L. projecta* but the main cusp is thicker and longer and the other denticles more numerous, smaller, and closer together with seven or eight in front and five behind the main cusp. In some respects it is like *L. subangulata* but the anterior denticles are more numerous and relatively smaller, the main cusp is much thicker and sharp edged instead of rounded, and the posterior denticles fewer with but five instead of seven or eight.

Occurrence.—Devonian (Rhinestreet) : Shaleton, N. Y.

Cotypes.—Cat. No. 11293, U.S.N.M.

LONCHODINA GENICULATA, new species

Plate 4, fig. 15

Like *L. subangulata* but the bar is even more sharply bent, the angle being almost rectangular and the denticles on the anterior part more sharply recurved, the main cusp being on a line with the anterior half of the bar. The main cusp is relatively shorter and somewhat sharp edged and the disproportion between its length and the denticles on the posterior part of bar is much less. The length of all but the first of the six posterior denticles is nearly or quite the same as that of the main cusp itself. The species resembles certain forms of *Prioniodina* like *P. subcurvata* but the bar is more strongly bowed outwardly, thicker, and the denticles more equal in length and all the lateral ones longer than in that species. In the bowing of the bar this is a true *Lonchodina*.

Occurrence.—Devonian (Rhinestreet) : Shaleton, N. Y.

Holotype.—Cat. No. 11294, U.S.N.M.

LONCHODINA DISCRETA, new species

Plate 10, figs. 1, 2

Based upon a young example and a large tooth of this species distinguished by the considerably curved bar and the denticles definitely separated from each other by spaces one to three times their own width. One subcentrally situated denticle may be called the main cusp being relatively larger and longer than the others. This is two to three times larger than the others and moderately recurved.

Occurrence.—Mississippian (Hardin sandstone) : Mount Pleasant, Tenn.

Cotypes.—Cat. No. 11014, U.S.N.M.

LONCHODINA RECTANGULATA, new species

Plate 10, fig. 4

Tooth strongly bowed with well separated denticles, the outer ones rather prominent and growing gradually smaller toward the middle. Species mainly characterized by the fact that the median teeth are smaller than in other species of this genus and also in lacking anything that can be compared to a major cusp.

Occurrence.—Mississippian (Hardin sandstone): Mount Pleasant, Tenn.

Holotype.—Cat. No. 11024, U.S.N.M.

HIBBARDELLA, new genus

Anterior and posterior ends equally developed in structure and angle to the axis of the main central cusp, the tooth thus being bilaterally symmetrical. Main cusp sharp edged, erect, and enormously developed, especially in its length. Lateral denticles are always separated, slightly curved inward, usually few, but varying considerably in number and length in different species.

Genotype.—*Hibbardella* (*Prioniodus*) *angulata* Hinde, 1879.

Range.—Upper Devonian and Early Mississippian.

This interesting new genus is named in honor of Raymond R. Hibbard, of Buffalo, N. Y., in recognition of his enthusiastic work upon the conodonts and other microfossils.

HIBBARDELLA ANGULATA Hinde, 1879

Plate 3, figs. 1-4

1879. *Prioniodus angulatus* HINDE, Quart-Journ. Geol. Soc. London, vol. 35, p. 360, pl. 15, fig. 17.

Even though our illustrations do not agree in all features with Hinde's figure, which was based upon an incomplete specimen, we feel certain of our correctness in identifying his species with the most abundant form of this generic type from the same horizon. In his figure the main cusp is narrower and the bar thicker, but we believe these differences are due to inaccurate drafting. Besides, as shown by our figures, the species is subject to considerable variation in the proportions of the bar and the relative size of the denticles on the latter. The main cusp has the usual character of sharp edges, one of the surfaces rounded, the other with a more or less well developed median angulation. The angle made by the two diverging parts of the bar is usually less than a rectangle, but varies from 80 to 90 degrees. The number of the lateral denticles is usually about five.

Occurrence.—Devonian (Rhinstreet): Eighteen Mile Creek and Shaleton, N. Y.

Pleisotypes.—Cat. No. 11295, U.S.N.M.

HIBBARDELLA SUBEQUALIS, new species

Plate 3, figs. 6, 7

Compared with *H. angulata*, in this new species the main cusp is relatively shorter, tapers throughout its length instead of being parallel sided, the bar is much thicker and the denticles on the whole more numerous (7) and more slender, more closely spaced, and the increase in size outwardly is more pronounced. The base is more arcuate, and the angle of the two sides is somewhat wider.

Occurrence.—Devonian (Rhinestreet): Shaleton, N. Y.

Cotypes.—Cat. No. 11296, U.S.N.M.

HIBBARDELLA MULTIDENS, new species

Plate 3, figs. 8, 9

In this species the angulation of the bar is less making a much wider angle between the arms, each of which is longer and carries nine relatively short denticles in all the specimens seen. The major cusp is very long, slender, parallel sided and seems particularly extended on account of the shortness of the lateral denticles. The flange at the base of the main cusp on the convex side is more clearly indicated than in other species.

Occurrence.—Devonian (Rhinestreet): Shaleton, N. Y.

Cotypes.—Cat. No. 11297, U.S.N.M.

HIBBARDELLA? CONFERTISSIMA, new species

Plate 3, fig. 5

Although apparently bilaterally symmetrical and consisting of a larger central main cusp with smaller denticles on each side, in which respect it agrees with *Hibbardella*, this species in the closeness of the denticles and other features must be placed here doubtfully. More specimens may show a closer relationship to such genera as *Euprioniodina*, *Synprioniodina*, and *Diplododella*. The species is so distinct from the associated forms that in spite of its doubtful generic affiliations we believe it worthy of description.

Occurrence.—Devonian (Rhinestreet): Shaleton, Erie County, N. Y.

Holotype.—Cat. No. 11298, U.S.N.M.

HINDEODELLA, new genus

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.

Genotype.—*Hindeodella subtilis*, new species.

Range.—Upper Devonian and Early Mississippian.

This genus includes a number of species with relations on one side to *Lonchodina* and perhaps more particularly to *Prioniodina* and on the other to *Prioniodus* but with other characters that are distinctly its own. Most of the species have a nearly straight bar but have a relatively strong and very long denticle near the broader end with a long series of smaller denticles, typically in alternating sizes, behind it. This general arrangement suggests *Prioniodus* from which *Hindeodella* is distinguished by having an anterior denticulated part with 1 to 8 or 10 small denticles developed in front of the main cusp and in lacking the downwardly projecting spur although this is simulated by the downward deflection of the corresponding part. However this deflected part is bowed horizontally rather than vertically so as to suggest a basketlike expansion at the end of a long bar. The division of the tooth into two denticulated parts suggest a relationship to *Prioniodina* and more particularly to *Euprioniodina* from both of which it is distinguished by the more slender, long and straighter bar and other peculiarities readily apparent on comparing the illustrations of their respective species.

HINDEODELLA SUBTILIS, new species

Plate 8, figs. 17-19

The species is particularly characterized by the minuteness of the denticles and their decided alternation in size, usually three very minute denticles occurring in the space between two that are much longer yet very slender. Base straight with only a moderate downward deflection at the anterior end. Main denticle two or three times as long as those on the bar; in front of it a narrow toothless space and then occurs a group of three or four teeth of which the terminal one is the largest. Specimen represented by figure 18 is supposed to be a variant of the same species.

Occurrence.—Mississippian (Hardin sandstone): Mount Pleasant, Tenn.

Cotypes.—Cat. No. 10985, U.S.N.M.

HINDEODELLA SIMILIS, new species

Plate 8, fig. 20

Similar to *H. subtilis* but the denticles on the bar are all of uniform size without noticeable alternation and the basketlike anterior expansion is of unusual size. At the anterior end the peculiar arrangement of the stronger teeth is shown in the figure.

Occurrence.—Mississippian (Hardin sandstone): Mount Pleasant, Tenn.

Holotype.—Cat. No. 11299, U.S.N.M.

HINDEODELLA LONGIDENS, new species

Plate 8, figs. 14, 15

General aspect as in the genotype *H. subtilis* but bar somewhat curved with much fewer, stronger, and longer denticles, all of which are of subequal size, well separated from each other of one set only, without alternation. Bar delicate and thin.

Occurrence.—Mississippian (Hardin sandstone): Mount Pleasant, Tenn.

Cotypes.—Cat. No. 10988, U.S.N.M.

HINDEODELLA RECTA, new species

Plate 8, fig. 16

Similar to *H. longidens* but the denticles are all much shorter, the bar straighter and thicker and the anterior projection reduced in length and carrying only a single denticle. The main cusp is also relatively much smaller and shorter.

Occurrence.—Mississippian (Hardin sandstone): Mount Pleasant, Tenn.

Holotype.—Cat. No. 10984, U.S.N.M.

HINDEODELLA ALTERNATA, new species

Plate 1, figs. 14, 15

In general aspect this tooth reminds considerably of *H. longidens* but is readily distinguishable by its less curved bar, more uniform denticulation and particularly by the presence of one or two shorter and smaller denticles between each pair of the much more conspicuous main set. As the two sets are not exactly aligned, care must be taken not to overlook the smaller set.

Occurrence.—Devonian (Rhinesreet): Shaleten, N. Y.

Cotypes.—Cat. No. 11300, U.S.N.M.

HINDEODELLA DECURRENS, new species

Plate 8, fig. 13

Bar curved, the expanded anterior part bent downward and inward and carrying three ridges or ribs rather than prominent denticles. Similar ribs occur behind the main denticle, which is large and strong, and the rest of the bar is occupied by closely set alternately large and long and much shorter minute denticles. This species also suggests departure from the type species toward *Euprioniodina* but after detailed comparison the preponderant alliance seems to favor *Hindeodella*.

Occurrence.—Mississippian (Hardin sandstone): Mount Pleasant, Tenn.

Holotype.—Cat. No. 10987, U.S.N.M.

HINDEODELLA SUBEQUALIS, new species

Plate 4, fig. 21

This species suggests a departure from the typical species of the genus towards *Euprioniodina*. This is indicated by the close nonalternating arrangement of the denticles and their more robust character. The anterior end is not sharply deflected as it should be in that genus but retains the essential features of *Hindeodella* though in subdued degree.

Occurrence.—Devonian (Rhinestreet): Shaleton, N. Y.

Holotype.—Cat. No. 11301, U.S.N.M.

DIPLODODELLA, new genus

Bilaterally symmetrical as in *Hibbardella* but denticles are fused and have minutely bifurcated terminations. The base also is relatively thicker and the sharp-edged major cusp smaller and shorter.

Genotype.—*Diplododella bilateralis*, new species. Early Mississippian.

DIPLODODELLA BILATERALIS, new species

Text fig. 21 (p. 16)

Specific characters as in the above diagnosis and as shown in figure 21.

Occurrence.—Mississippian (Chattanooga shale): 13 miles east of north of Huntsville, Ala.

Holotype.—Cat. No. 11306, U.S.N.M.

PALMATODELLA, new genus

Though essentially like *Prioniodina* the general aspect is very different, the bar or posterior half being straighter, much longer and slender like a hirsute spine, the anterior end longer, triangular in outline, much wider than the posterior and bent at right angles to it and all denticles much finer, hairlike, sharply directed forward and for the most part fused.

Genotype.—*Palmatodella delicatula*, new species. Early Mississippian.

PALMATODELLA DELICATULA, new species

Text fig. 20 (p. 16); Plate 10, p. 5

The strikingly palmlike aspect of the species makes it easily recognized. Other features of the species are given in the generic diagnosis.

Occurrence.—Mississippian (Chattanooga shale): 13 miles east of north of Huntsville, Ala.

Holotype.—Cat. No. 11307, U.S.N.M.

SYNPRIONIODINA, new genus

Like *Palmatodella* except that the downturned anterior part is much smaller, bar thicker, denticles not turning forward so sharply and the main cusp proportionately very large. Probably more closely allied to *Euprioniodina* the essential difference being the almost complete lateral fusion of the denticles.

Genotype.—*Synprioniodina alternata*, new species.

Range.—Upper Devonian and Early Mississippian.

SYNPRIONIODINA ALTERNATA, new species

Text fig. 22 (p. 16)

Main cusp large, straight, rounded and directed as much forward as upward. Denticles on bar consisting of two alternating subequal sets, not strongly inclined, laterally fused, numerous, rather short slender, those on the downturned subtriangular anterior part directed forward, about seven in number, all of same width but decreasing regularly in length from above downward.

Occurrence.—Mississippian (Chattanooga shale): 13 miles east of north of Huntsville, Ala.

Holotype.—Cat. No. 11308, U.S.N.M.

Genus LONCHODUS Pander, 1856

Text fig. 16 (p. 16)

The genus *Lonchodus* originally described as *Centroodus* by Pander* but changed by him to *Lonchodus* on account of priority is undoubtedly based upon broken incomplete remains of teeth which as our illustrations show might belong to any one of several distinct genera. As it is probable that the true characters of the genus now can not be accurately determined the only use we can suggest for the name is to continue employing it for species based upon similar imperfect and generically indeterminable material.

Genotype.—*Lonchodus (Centroodus) simplex* Pander, 1856.

Genus CORNURAMIA Smith, 1907

Text figs. 1, 2 (p. 16)

"In this genus there is a double-pointed, hornlike beam" (Smith, 1907).

No American species of this type is known.

Genotypes.—*Cornuramia monodonta* Smith, 1907. Ordovician of Scotland.

Genus PACHYSOMIA Smith, 1907

Text fig. 4 (p. 16)

“Beam thick and curving, one extremity with a knoblike termination, other end sharp” (Smith, 1907). This type of structure has not been found in American strata.

Genotype.—*Pachysomia wanlockensis* Smith, 1907. Ordovician of Scotland.

Genus VALENTIA Smith, 1907

Text fig. 17 (p. 16)

“From a deep, thin plate a few long slender teeth spring” (Smith, 1907). Based apparently upon a fragmentary specimen.

Genotype.—*Valentia morrochensis* Smith, 1907. Ordovician of Scotland.

Genus PRIONOGNATHUS Pander, 1856

Text figs. 18, 19 (p. 16)

As our copies of the original illustrations show it is possible that this genus does not belong to the conodonts.

Genotype.—*Prionognathus brandtii* Pander, 1856. Silurian. Island of Oesel.

Family POLYGNATHIDAE, new family

Plates with a high denticulated median or lateral crest which is often extended stalklike from one end.

Polygnathus (Hinde) Bryant, 1921, *Ancyrodella*, new genus, and *Palmatolepis*, new genus, are referred to this family without question but *Gnathodus* Pander, 1856, *Panderodella*, new genus, and *Otenognathus* Pander, 1856, are placed here provisionally.

Genus POLYGNATHUS (Hinde) Bryant, 1921

Polygnathus was founded by Hinde upon a group of plates and teeth occurring associated on the same slab of Rhinestreet shale from western New York which he believed to represent the remains of a single animal. In this assemblage no less than five genera as now understood were represented, and it would have been better to have discarded the genus. Since Bryant has redefined the genus and selected a genotype, *P. pennatus*, which he says is represented in Hinde's type assemblage of *P. dubius* in the edge view of the common *Genundewa* species the genus may be recognized in this restricted sense. Based upon species in accord with the genotype selected by Bryant, *Polygnathus* may be defined as follows:

Plate subsymmetrically lanceolate, traversed by a high median carina extending stalklike from the broader end and reaching, although diminishing gradually in height, to the opposite usually

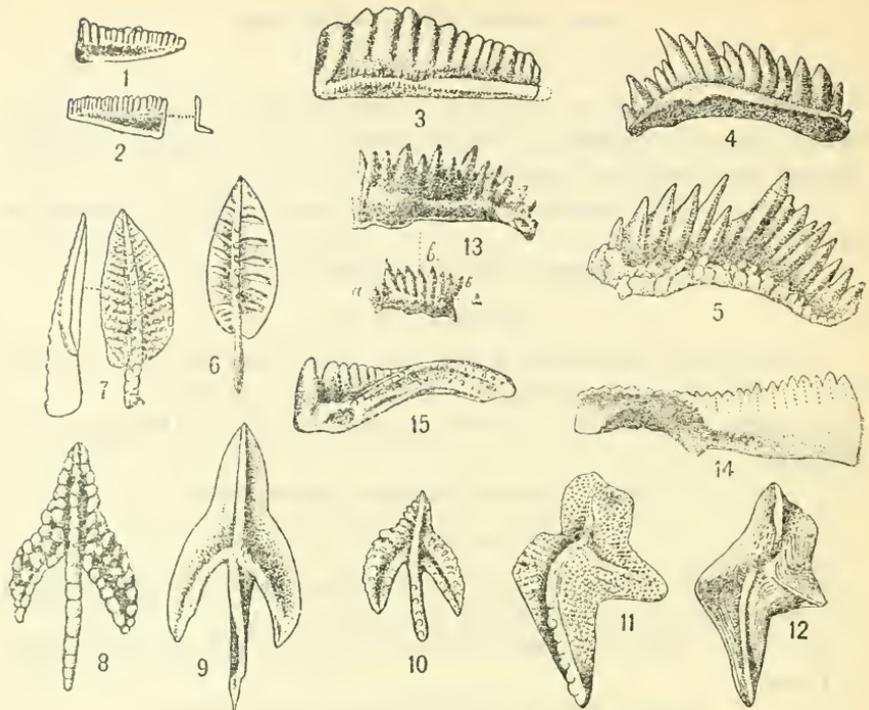


FIG. 5.—POLYGNATHIDAE, NEW FAMILY

- 1-3. Genus *Panderodella*, new genus. 1, 2. Views of right and left plates with cross section, of the genotype *Panderodella truncata*, new species, $\times 20$. Base of Mississippian (Hardin sandstone), Mount Pleasant, Tenn. 3. Lateral view of *Panderodella subcrassa*, new species, $\times 20$, from the same horizon and locality.
- 4, 5. Genus *Polygnathellus*, new genus. The genotype *Polygnathellus typicalis*, new species, $\times 20$. Upper Devonian (Rhinestreet shale of Portage), Shaleton, N. Y.
- 6, 7. Genus *Polygnathus* (Hinde) Bryant, 1921. 6. View of upper surface of plate of *Polygnathus pennatus* Hinde, 1879, selected by Bryant as the genotype. Upper Devonian (Genundewa limestone of Genesee), Eighteen Mile Creek, N. Y. 7. Upper and side views of plate of *Polygnathus pennatulus* new species, $\times 20$, a similar species from the base of Mississippian (Hardin sandstone), Mount Pleasant, Tenn.
- 8-10. Genus *Ancyrodella*, new genus. 8, 9. Upper and lower surfaces of the genotype *Ancyrodella nodosa*, new species, $\times 20$. Devonian (Rhinestreet), Shaleton, N. Y. 10. Upper surface of *Ancyrodella hamatus*, new species, $\times 20$, Hardin sandstone, Mount Pleasant, Tenn.
- 11, 12. Genus *Palmatolepis*, new genus. Upper and lower surface of the genotype *Palmatolepis perlobata*, new species. Hardin sandstone, Mount Pleasant, Tenn.
13. Genus *Ctenognathus* Pander, 1856. Views of the genotype *Ctenognathus murchisoni* Pander, 1856. Silurian. Island of Oesel.
14. Genus *Gnathodus* Pander, 1956. Pander's illustration of the genotype *Gnathodus mosquensis* Pander, 1956. Carboniferous of Russia. 15. Side view of a plate of *Polygnathus* from Hardin sandstone at Mount Pleasant, Tenn., showing resemblance to *Gnathodus*.

pointed end, dividing the plate into two lateral, subequal areas. The carina is also indicated by a corresponding ridge on the underside. 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 underside is smooth or with fine concentric lines.

POLYGNATHUS RIMULATUS, new species

Plate 1, figs. 8, 9

This is a much smaller species than the genotype *P. pennatus*, which it resembles in general aspect but differs structurally in the fact that the edge of the lanceolate plate is definitely raised in a continuous minutely nodose rim. The depressed spaces between this rim and the central crest are also smaller and on the whole give much less the appearance of outwardly enlarging rows of nodes characterizing that species.

Occurrence.—Devonian (Rhinestreet): Shaleton, N. Y.

Cotypes.—Cat. No. 11302, U.S.N.M.

POLYGNATHUS PENNATULUS, new species

Plate 7, fig. 8; Plate 9, figs. 24, 25

Our views illustrate the top, profile, and cross section showing crest and concave lateral areas with margins elevated nearly to level of crest. The outline is lanceolate, although not quite equilateral, but the species is distinguished from others of similar form by the surface markings, the crest having a double row of tubercles and the lateral areas covered by pinnately arranged similar tubercles.

Occurrence.—Mississippian (Hardin sandstone): Mount Pleasant, Tenn.

Holotype.—Cat. No. 10996, U.S.N.M.

POLYGNATHUS DELICATULUS, new species

Plate 7, figs. 9, 10

Closely related to *P. pennatulus* but markings more delicate and arranged more transversely. These markings take the form of numerous parallel striations arranged nearly at right angles to the prominent median crest.

Occurrence.—Mississippian (Hardin sandstone): Mount Pleasant, Tenn.

Cotypes.—Cat. No. 10994, U.S.N.M.

POLYGNATHUS FOLIUM, new species

Plate 7, fig. 5

Crest simple with parallel vein-like striations crossing the flattish lateral areas.

Occurrence.—Mississippian (Hardin sandstone): Mount Pleasant, Tenn.

Holotype.—Cat. No. 11012, U.S.N.M.

POLYGNATHUS RHOMBOIDEUS, new species

Plate 7, fig. 6

Our figure shows the upper side of plate illustrating rather regularly rhombic outline and coarse longitudinally arranged tubercles of the lateral areas with a row of similar tubercles on the posterior third of the crest.

Occurrence.—Mississippian (Hardin sandstone): Mount Pleasant, Tenn.

Holotype.—Cat. No. 11013, U.S.N.M.

POLYGNATHUS GERMANUS, new species

Plate 7, figs. 11, 12

Related to *P. rhomboideus*, but has a more regularly lanceolate outline and lacks the tubercles on the crest.

Occurrence.—Mississippian (Hardin sandstone): Mount Pleasant, Tenn.

Holotype.—Cat. No. 10997, U.S.N.M.

POLYGNATHUS GLABER, new species

Plate 7, fig. 13

A lanceolate species doubtless allied to *P. peracutus* Bryant from the Genundewa limestone (Devonian) of New York, but differing conspicuously from it in its smooth instead of coarsely tuberculated surface.

Occurrence.—Mississippian (Hardin sandstone): Mount Pleasant, Tenn.

Holotype.—Cat. No. 11004, U.S.N.M.

POLYGNATHUS CONFLUENS, new species

Plate 7, figs. 14, 15

This new species belongs to the typical (lanceolate) group but is readily distinguished by the confluence and somewhat concentric

arrangement of the series of surface nodes. The crest is apparently without nodes.

Occurrence.—Mississippian (Hardin sandstone): Mount Pleasant, Tenn.

Cotypes.—Cat. No. 10998, U.S.N.M.

POLYGNATHUS SUBLATUS, new species

Plate 8, fig. 2

Quite similar to *P. pennatulus* except that the whole form is broader, the lateral area flatter, the mid-rib does not reach the anterior extremity, and the rows of tubercles have a tendency to radial arrangement.

Occurrence.—Mississippian (Hardin sandstone): Mount Pleasant, Tenn.

Holotype.—Cat. No. 11009, U.S.N.M.

POLYGNATHUS? ACAULIS, new species

Plate 8, figs. 4, 5

Our illustrations of the upper and lower surfaces of two plates show the characteristic triangular outline and absence of stalklike projection of the median crest. Hinde gives poor figures of two specimens named *P. truncatus*, which must be related to this species. These are also of triangular form and lack the stalk. Even the median crest is not represented on the larger of the two which moreover comes from a very different geological horizon. Until specimens of Hinde's species are found, fuller comparisons are not possible. The present species differs from all others and must be considered a doubtful form of the genus.

Occurrence.—Mississippian (Hardin sandstone): Mount Pleasant, Tenn.

Cotypes.—Cat. No. 11003, U.S.N.M.

POLYGNATHUS CONCENTRICUS, new species

Plate 8, figs. 6, 7

We figure the upper and lower surfaces of two plates, the former showing the highly ornamental concentric arrangement of the surface tubercles reminding of *P. confluens* but the specimens are larger and the outline is less regularly lanceolate.

Occurrence.—Mississippian (Hardin sandstone): Mount Pleasant, Tenn.

Cotypes.—Cat. No. 11002, U.S.N.M.

POLYGNATHUS CRASSULUS, new species

Plate 8, figs. 8-10

Lower (8) and top (10) views of the same specimen with figure 9, representing a three-quarters basal and edge view. The outline and markings tend to be irregular although the lanceolate form is maintained. The crest runs through on both surfaces although very high in posterior part of upper side. Anterior half of upper surface irregularly tuberculated and posterior half irregularly plicated. Lower surface with concentric lines and undulations.

Occurrence.—Mississippian (Hardin sandstone): Mount Pleasant, Tenn.

Holotype.—Cat. No. 11001, U.S.N.M.

ANCYRODELLA, new genus

Similar to *Polygnathus* but the depressed lateral areas are drawn out at the wider end so as to give the whole plate an anchor like outline.

Genotype.—*Ancyrodella nodosa*, new species.

Range.—Upper Devonian and lower Mississippian.

ANCYRODELLA NODOSA, new species

Plate 1, figs. 10-13

Plate anchor or somewhat harpoon shaped, essentially bilateral in form with a central crest prolonged posteriorly into the free shaft like extension, and rather narrow posteriorly, widely diverging but finally incurving, flukelike lateral limbs. The median crest and also the median lines of the flukes are made by a series of basally connected strong nodes and a similar row of nodes form an elevated edge around the whole fluke.

Occurrence.—Devonian (Rhinestreet): Shaleton, N. Y.

Cotypes.—Cat. No. 11303, U.S.N.M.

ANCYRODELLA HAMATA, new species

Plate 7, fig. 7

Readily distinguished from the genotype by lacking the row of nodes on the lateral appendages. As in that species the shape simulates the head of a harpoon. The shaft passes into a median crest extending to the anterior extremity with the marginal portions throughout, coarsely tuberculate.

Occurrence.—Mississippian (Hardin sandstone): Mount Pleasant, Tenn.

Holotype.—Cat. No. 11011, U.S.N.M.

ANCYRODELLA SYMMETRICA, new species

Plate 8, fig. 1

Evidently a lineal descendant of *A. (Polygnathus) tuberculata* Hinde from the Genundewa limestone of western New York. These species differ, however, conspicuously in that *A. symmetrica* lacks entirely the coarse tubercles. Among other differences, the flukelike extensions are not definitely separated from the anterior part. Again the anterior part of the plate has developed a pair of posteriorly diverging low ridges.

Occurrence.—Mississippian (Hardin sandstone): Mount Pleasant, Tenn.

Holotype.—Cat. No. 11008, U.S.N.M.

ANCYRODELLA MALLEUS, new species

Plate 7, figs. 1, 2

Differs from *A. symmetrica* in the unsymmetrical hammerlike shape which is produced by the reduction or truncation of the anterior part of plate but resembling it in its bifurcated recurved crest and lack of surface tubercles.

Occurrence.—Mississippian (Hardin sandstone): Mount Pleasant, Tenn.

Cotypes.—Cat. No. 11006, U.S.N.M.

PALMATOLEPIS, new genus

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*, new species.

Range.—Upper Devonian and Lower Mississippian.

PALMATOLEPIS PERLOBATA, new species

Plate 7, figs. 19-23

Five specimens are figured, two lower (19, 21) and two upper (20, 22) showing the tendency to obsolescence of the lateral branch of the median crest, the irregular although decidedly lobate outline and the decided curvature of the crest. Figure 23 represents a more triangular possible variant of this species.

Occurrence.—Mississippian (Hardin sandstone): Mount Pleasant, Tenn.

Cotype.—Cat. No. 10995, U.S.N.M.

PALMATOLEPIS BIFURCATA, new species

Plate 7, figs. 16, 17

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.

Occurrence.—Mississippian (Hardin sandstone): Mount Pleasant, Tenn.

Cotypes.—Cat. No. 11010, U.S.N.M.

PALMATOLEPIS ASYMMETRICA, new species

Plate 7, fig. 18

A member of the bifurcata group but readily distinguished by the extreme divergence of the bifurcation, by the unsymmetrical arrangement of its parts and the irregularly triangular outline.

Occurrence.—Mississippian (Hardin sandstone): Mount Pleasant, Tenn.

Holotype.—Cat. No. 11000, U.S.N.M.

PALMATOLEPIS EXTRALOBATA, new species

Plate 8, fig. 3

Founded on a single specimen showing the under side. Similar to *P. perlobata* and possibly a variant of it but differing in the presence of an extra fan-shaped lobe along the anterior side and the sharp angle of divergence to the right of both branches of the crest.

Occurrence.—Mississippian (Hardin sandstone): Mount Pleasant, Tenn.

Holotype.—Cat. No. 11007, U.S.N.M.

PALMATOLEPIS LOBATULA, new species

Plate 7, figs. 3, 4

Distinguished by the lobate outline, peculiarly curved crest bifurcating anteriorly, one of the branches running off at right angles to the top of the lateral lobe and by the finely lineate ornament present everywhere except on the denticulated summit of the posterior half of the main crest.

Occurrence.—Mississippian (Hardin sandstone): Mount Pleasant, Tenn.

Cotypes.—Cat. No. 11005, U.S.N.M.

PALMATOLEPIS PECULIARIS, new species

Plate 8, figs. 11, 12

Our illustrations are of the upper surface of opposite plates, one with peculiar anterior process which if normal has been lost on the other specimen. Species distinguished by complete or partial obsolescence of the forks of the carina and the general peculiar shape. Surface finely granulose, the granules being usually arranged in neat lines running from the median crest to the outer edges. Large node at upper extremity of crest and a row of smaller ones extending nearly to the posterior extremity. The relations of the species seem to be with *P. extralobata* the anterior process being correlated with the extra lobe in that species.

Occurrence.—Mississippian (Hardin sandstone): Mount Pleasant, Tenn.

Cotypes.—Cat. No. 10999, U.S.N.M.

PALMATOLEPIS GLABER, new species

Plate 9, figs. 18-20

Distinguished from other species of this genus by the unusual narrowness of the plate as a whole and by the exceeding minuteness of the surface markings. The latter consist of very fine inosculating lines barely distinguishable under a 20-diameter enlargement. There is a distinct trace of the bifurcation, but the lateral lobe is practically obsolete, although the prolongation at the knob is indicated. The crest dies out before reaching the anterior extremity, but is prominent and strong in the middle and posterior parts.

Occurrence.—Mississippian (Hardin sandstone): Mount Pleasant, Tenn.

Cotypes.—Cat. No. 11043, U.S.N.M.

PALMATOLEPIS PUNCTATA Hinde, 1879

Plate 1, figs. 6, 7

1879. *Polygnathus punctatus* HINDE, Quart. Journ. Geol. Soc. London, vol. 35, p. 367, pl. 17, fig. 14.

Although named *Polygnathus punctatus* by Hinde, his description very definitely says, "Surface of plate is covered by very minute tubercles." Both the original description and figure are indefinite as to the details of form and marking of plate, and in one feature they depart from the description, but we still have little hesitancy

in identifying the specimens figured on plate 1 with Hinde's species. Our specimens, of which there are many and all surprisingly alike, differ from Hinde's description and figure in that the carina, although becoming very thin, is nevertheless distinguishable quite to the edge of the plate. This feature is even better indicated on the lower side. The arrangement of the surface tuberculation indicates a rather decided radial arrangement of the rows of tubercles, which in certain lights appear like simple raised lines. The carina of the branch to the lateral lobe leaves the main crest at approximately right angles. It is thin in its inner part, but the branch thickens toward the margin of the plate.

Occurrence.—Devonian (Rhinestreet): Shaletton, N. Y.

Plesiotypes.—Cat. No. 11309, U.S.N.M.

PANDERODELLA, new genus

Platelike structures consisting mainly of a high but thin pectinated crest with a broad basal expansion (plate proper) developed on one side of crest only and extending its full length.

This genus comprises a series of structures trending toward the leaflike *Polygnathus* plates but differing in that the pectinated crest is the major part of the structure and the basal expansion or plate proper is developed only on one side. The crest is highest at one end, presumably the posterior one. It differs again in that the lateral area extends the full length of the crest. The cross section of the plate and crest is therefore L-shaped. The basal expansion is smooth. The denticles of the crest are joined, becoming free only at their tips.

Genotype.—*Panderodella truncata*, new species.

Range.—Upper Devonian and Early Mississippian.

Although we provisionally assign this genus to the Polygnathidæ, the fact that several species show a protuberance near the middle of the unflanged side, a feature common in many typical conodonts, makes it possible that the genus does not represent a dermal plate.

Polygnathus scitulus Hinde and *P. solidus* Hinde apparently belong to this genus.

PANDERODELLA TRUNCATA, new species

Plate 9, figs. 15-17

Plate as a whole characterized by rectangular broader end tapering slowly to a point of less than half the height at the other end and by the rather narrow and not sharply bowed over basal flange and small regular subequal denticles laterally in contact.

Occurrence.—Mississippian (Hardin sandstone): Mount Pleasant, Tenn.

Cotypes.—Cat. No. 11040, U.S.N.M.

PANDERODELLA SUBCRASSA, new species

Plate 9, fig. 14

Similar to *P. truncata* but much larger and with relatively much coarser denticles, shorter form, thicker flange, and somewhat curved crest. The denticles decrease in size from the broader end.

Occurrence.—Mississippian (Hardin sandstone): Mount Pleasant, Tenn.

Holotype.—Cat. No. 11042, U.S.N.M.

PANDERODELLA MAXILLARIS, new species

Plate 9, fig. 21

Characterized by the great thickening of the anterior part of the jawlike plate and the swelling just under the denticles. The flange is only of moderate width.

Occurrence.—Mississippian (Hardin sandstone): Mount Pleasant, Tenn.

Cotypes.—Cat. No. 11041, U.S.N.M.

POLYGNATHELLUS, new genus

Similar to *Panderodella* with a curved crest made up of joined, mostly sharp-edged denticles, longest in the middle and shortening towards the two ends. On the convex side there is a very narrow, smooth basal expansion, while on the concave side occurs a wider flange, the upper surface of which is tuberculated as in *Polygnathus*. In side view the plate, especially the crest, reminds of *Bryantodus*, but the development of the concave tuberculated basal expansion on one side is quite different and causes us to believe the generic relations are more with *Polygnathus*.

Genotype.—*Polygnathellus typicalis*, new species.

Range.—Upper Devonian, Early Mississippian.

Besides the two species herein described, *Prioniodus colligatus* Bryant, 1921, appears to have the characters of this genus.

POLYGNATHELLUS TYPICALIS, new species

Plate 1, figs. 1-3

Our views illustrating the two sides and the bottom of the plate bring out the features discussed above in the generic diagnosis as based upon this the type species.

Occurrence.—Devonian (Rhinestreet): Shaleton, N. Y.

Cotypes.—Cat. No. 11304, U.S.N.M.

POLYGNATHELLUS CURVATUS, new species

Plate 1, fig. 4

The specimen of which the impression of the concave side is shown in Figure 4 is supposed to represent a distinct species, differing from the genotype in the much greater curvature of the plate as seen in lateral view. The basal expansion is narrower and its surface is not so distinctly tuberculated. In other respects the two species are essentially the same.

Occurrence.—Devonian (Rhinestreet): Shaleton, N. Y.

Holotype.—Cat. No. 11305, U.S.N.M.

Genus GNATHODUS Pander, 1856

After much speculation as to what *Gnathodus* may really be, we must admit failure to reach a satisfactory conclusion. All the specimens we first believed to belong here have proved to be side views of species of *Polygnathus*. It is possible that Pander's figure of *Gnathodus mosquensis* may also be such a side view with the crest showing the height of the posterior extension of the crest and the plate crumpled or broken away. Bryant believed that the genus might be retained and placed here an American Devonian species in which the flanges of the plates are very little developed. This may be true but we have seen no specimen which conclusively establishes this view. For the present we must leave *Gnathodus* out of consideration in describing American conodonts.

?GNATHODUS, species

Plate 1, fig. 5

We have illustrated an example with the kind of appearance that we had supposed might be referable to *Gnathodus* if that should really prove to be a distinct genus. On further more careful examination of this and similar specimens we were forced to the conclusion that they represent merely side views of *Polygnathus* forms with the crest shown in its full height and the expansions making the plate broken.

Occurrence.—Devonian (Rhinestreet): Shaleton, N. Y.

Genus CTENOGNATHUS Pander, 1856

Considering *C. purchisoni* as the genotype, this genus is of very doubtful relations and may not be a true conodont at all. The figures of the second species *C. verneuilli* suggest at least three generic types, while the last species *C. keyserlingi* shows no characters definitely recognizable among any of our forms. Under these circumstances *Ctenognathus* must be provisionally set aside as insufficiently established.

EXPLANATION OF PLATES

PLATE 1

All the illustrations on this plate are magnified 15 diameters and the specimens are from the Rhinestreet shale of the Portage group at Shaleton, Erie County, N. Y.

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(3) View exhibiting convex side of basal expansion.	
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Upper surfaces of two examples of this minute species.	
10-13. <i>Ancyrodella nodosa</i> , new species.....	48
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Two examples of this fine large species.	

PLATE 2

Illustrations all magnified 15 diameters and specimens are from the Rhinestreet shale of the Portage group at Shaleton, Erie County, N. Y.

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PLATE 3

Specimens here illustrated are from the Rhinestreet shale at Shaleton, N. Y., and illustrations are magnified 15 diameters.

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The type specimen of this minute species.	
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Two specimens, one (7) a mold in the rock, illustrating the short main cusp and the thick bar.	
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PLATE 4

Specimens here illustrated are from the Rhinestreet shale at Shaleton, Erie County, N. Y., and illustrations are magnified 15 diameters.

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Views showing the generic characters, discrete denticles on each side of main cusp.	

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PLATE 5

Specimens here illustrated are from the Rhinestreet shale at Shaletou, N. Y., and the illustrations are magnified 15 diameters.

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6, 7. <i>Lonchodina perlonga</i> , new species -----	32
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11. <i>Lonchodina delicatula</i> , new species -----	33
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PLATE 6

Specimens here illustrated are from the Rhinestreet shale at Shaletton, N. Y., and the illustrations are magnified 15 diameters.

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PLATE 7

The specimens here illustrated are from the Hardin sandstone basal member of the Mississippian-Chattanooga black shale at Mount Pleasant, Tenn. Magnification, $\times 15$.

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PLATE 8

All the illustrations on this plate are magnified 15 diameters. The specimens are from the Hardin sandstone basal member of the Mississippian-Chattanooga black shale at Mount Pleasant, Tenn.

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PLATE 9

The illustrations on this plate are magnified 15 diameters, and the specimens are from the Hardin sandstone basal member of the Mississippian-Chattanooga black shale at Mount Pleasant, Tenn.

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PLATE 10

All the illustrations on this plate are magnified 15 diameters. The specimens are from the Hardin sandstone basal member of the Mississippian-Chatanooga black shale at Mount Pleasant, Tenn.

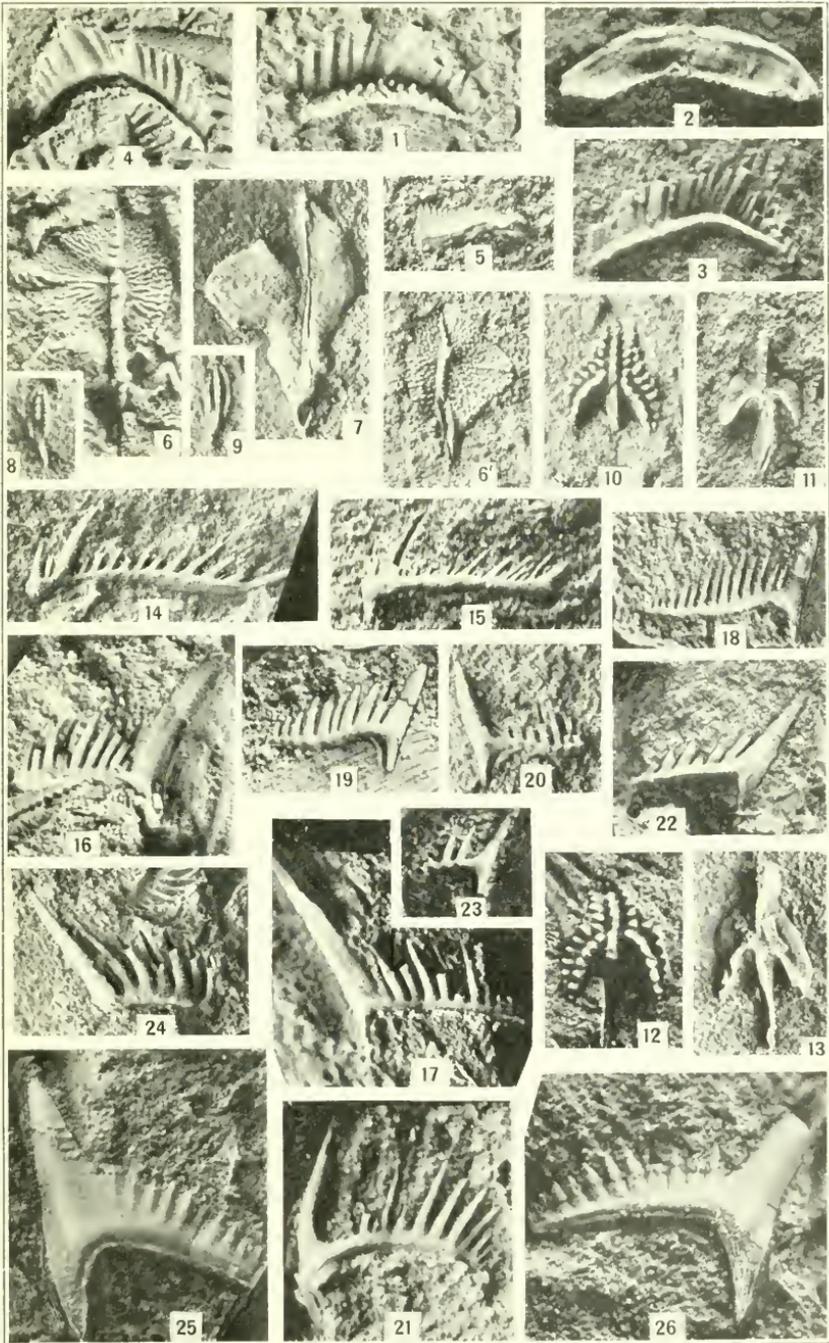
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FIG. 1, 2. <i>Lonchodina discreta</i> , new species.....	36
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PLATE 11

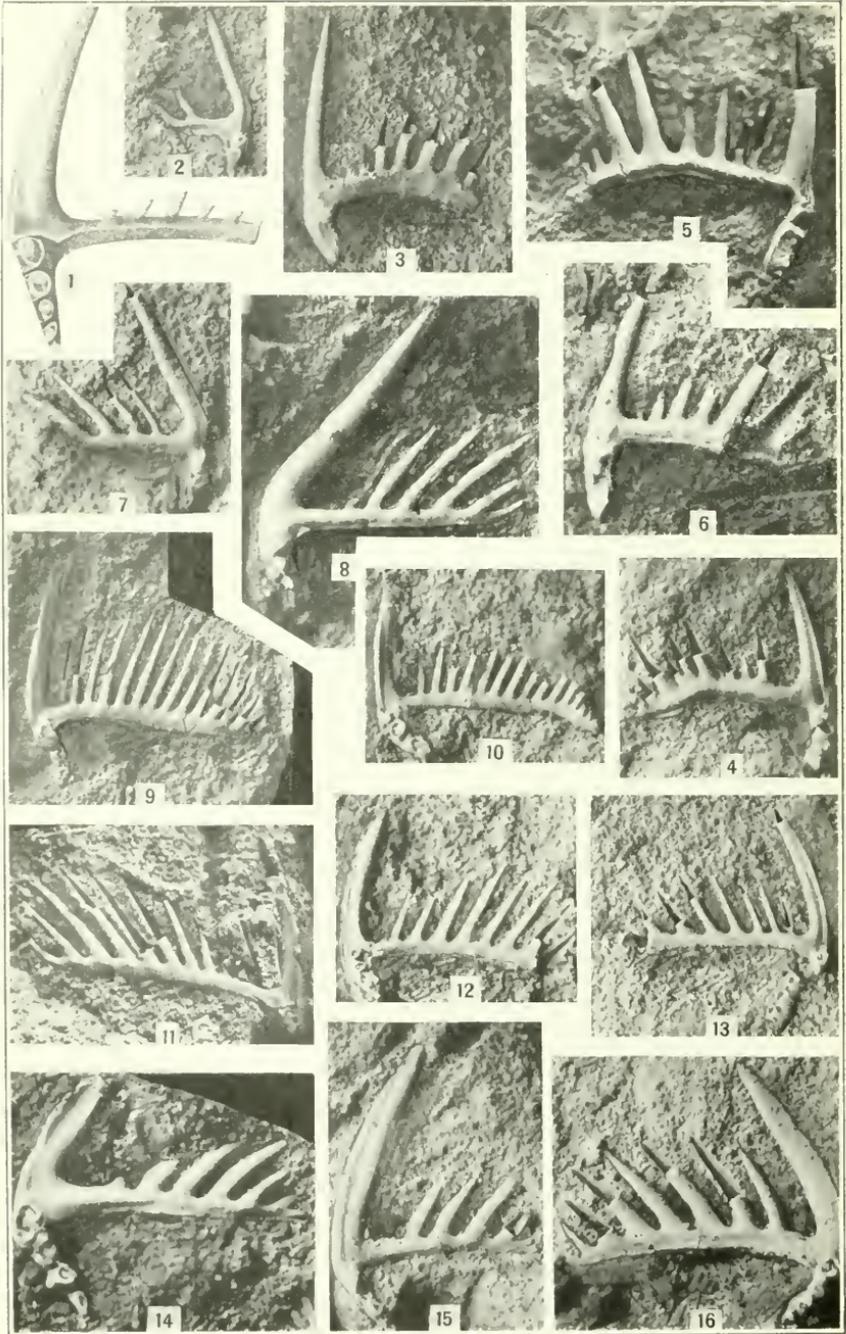
1. Jaw, $\times 2.5$, of small selachian from Sandwich Islands, showing teeth and dermal plates.
2. Teeth of same, $\times 6$, illustrating median denticles and basal prong for attachment in jaw, similar to conodonts.
3. Dermal plates of the same specimen, $\times 20$.
- 4, 5. Portion of jaw of a recent shark, $\times 2.5$ and $\times 6$, exhibiting arrangement of teeth and their similarity to conodont genera like *Bryantodus*. The little variation in the shape of the teeth is also apparent.
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7. Dermal plates of the recent shark *Eulamia obtusa*, $\times 20$.
8. Skin of another recent shark *Platypodon*, $\times 20$, with small closely arranged dermal plates.





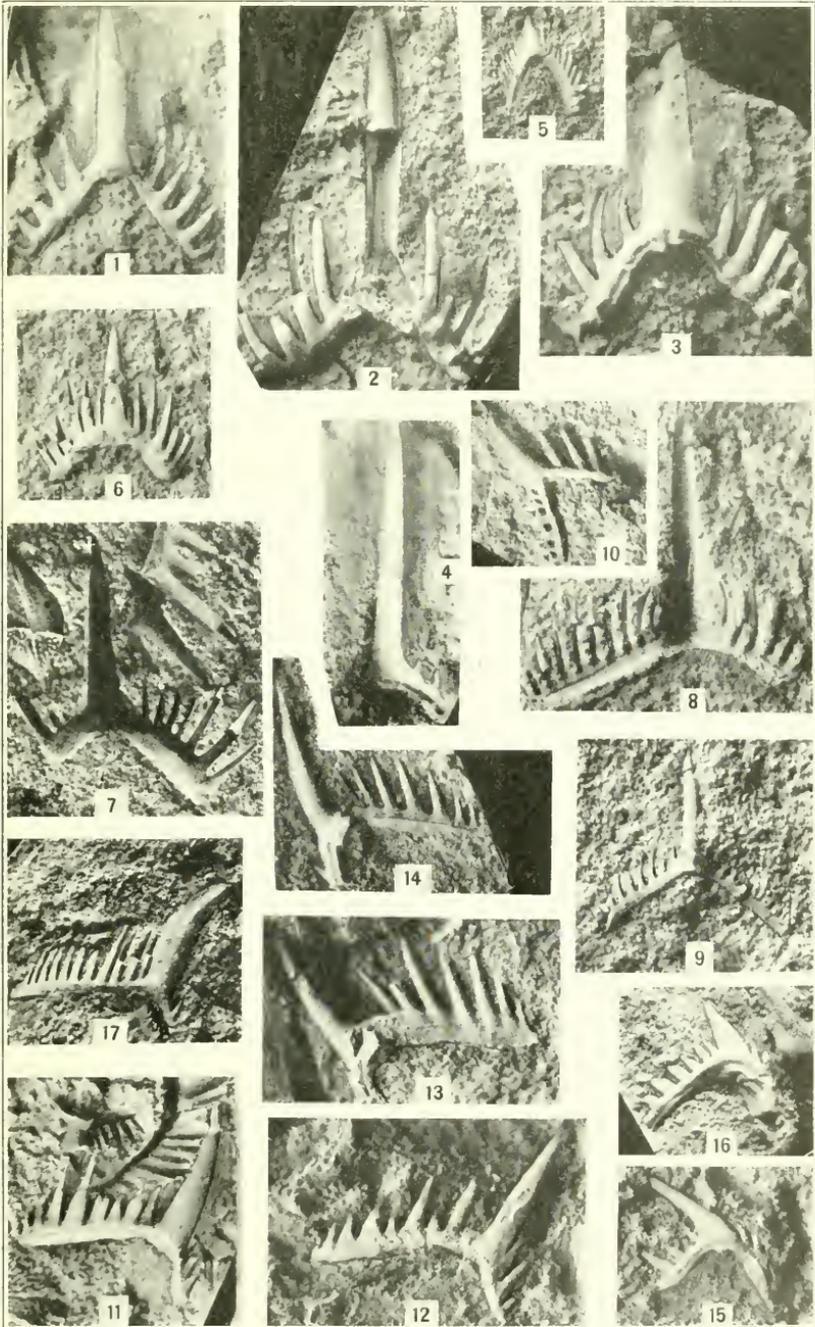
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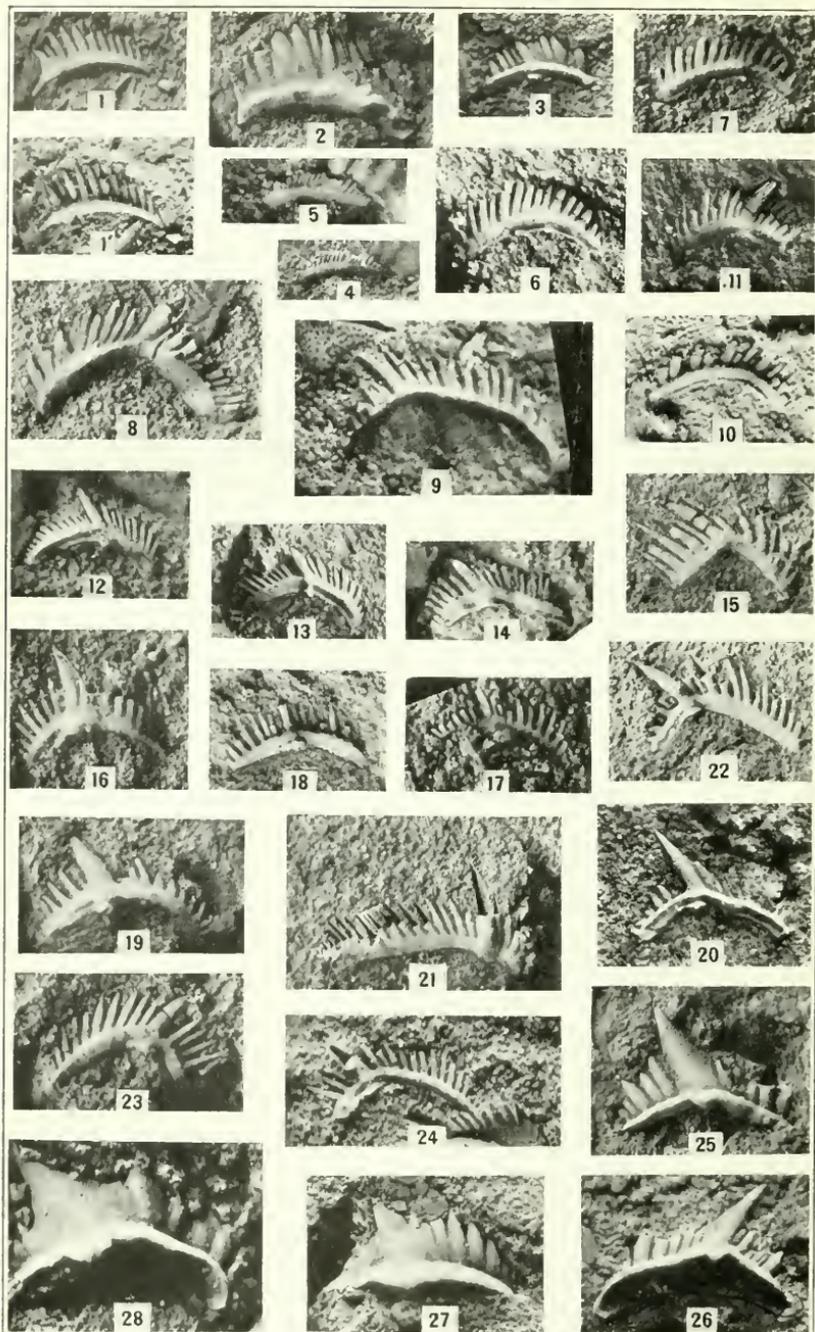
AMERICAN DEVONIAN CONODONTS

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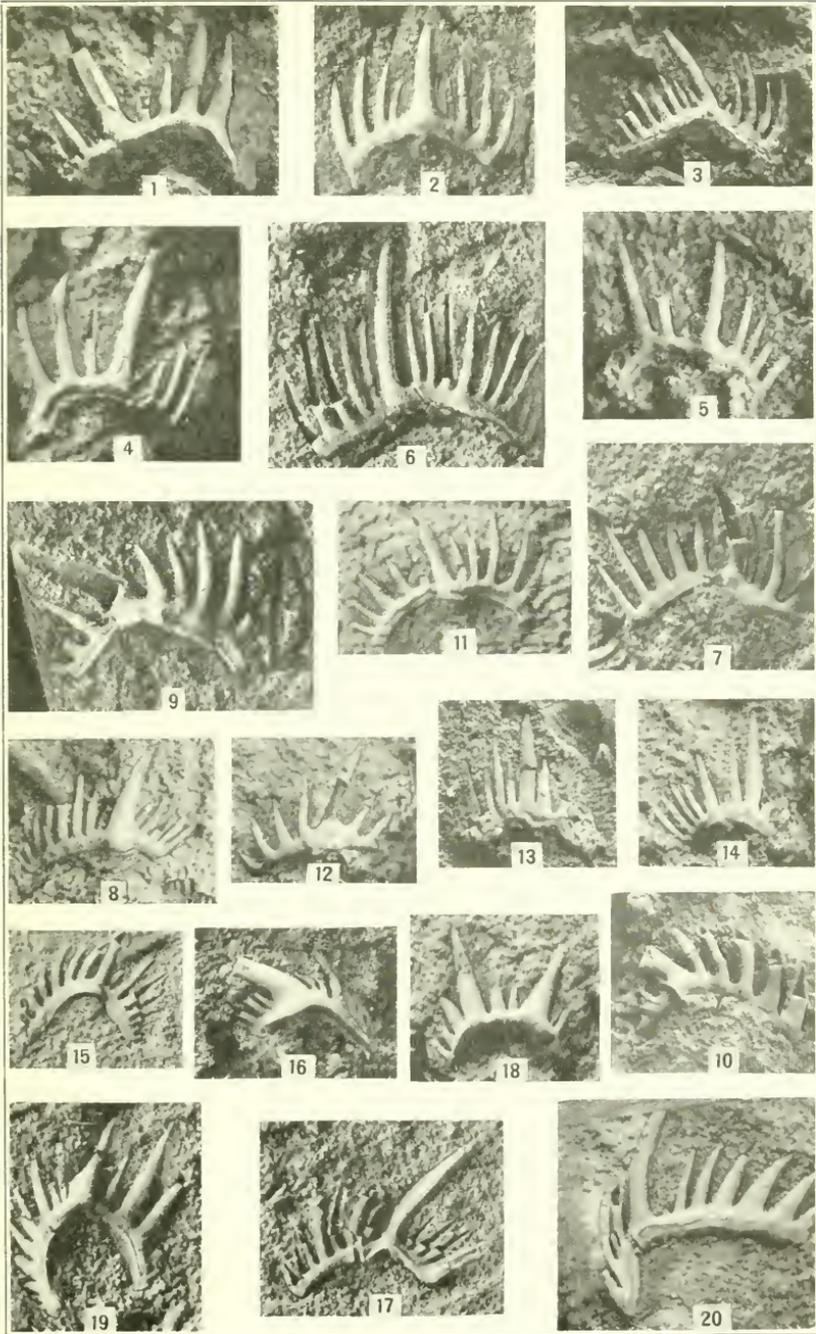
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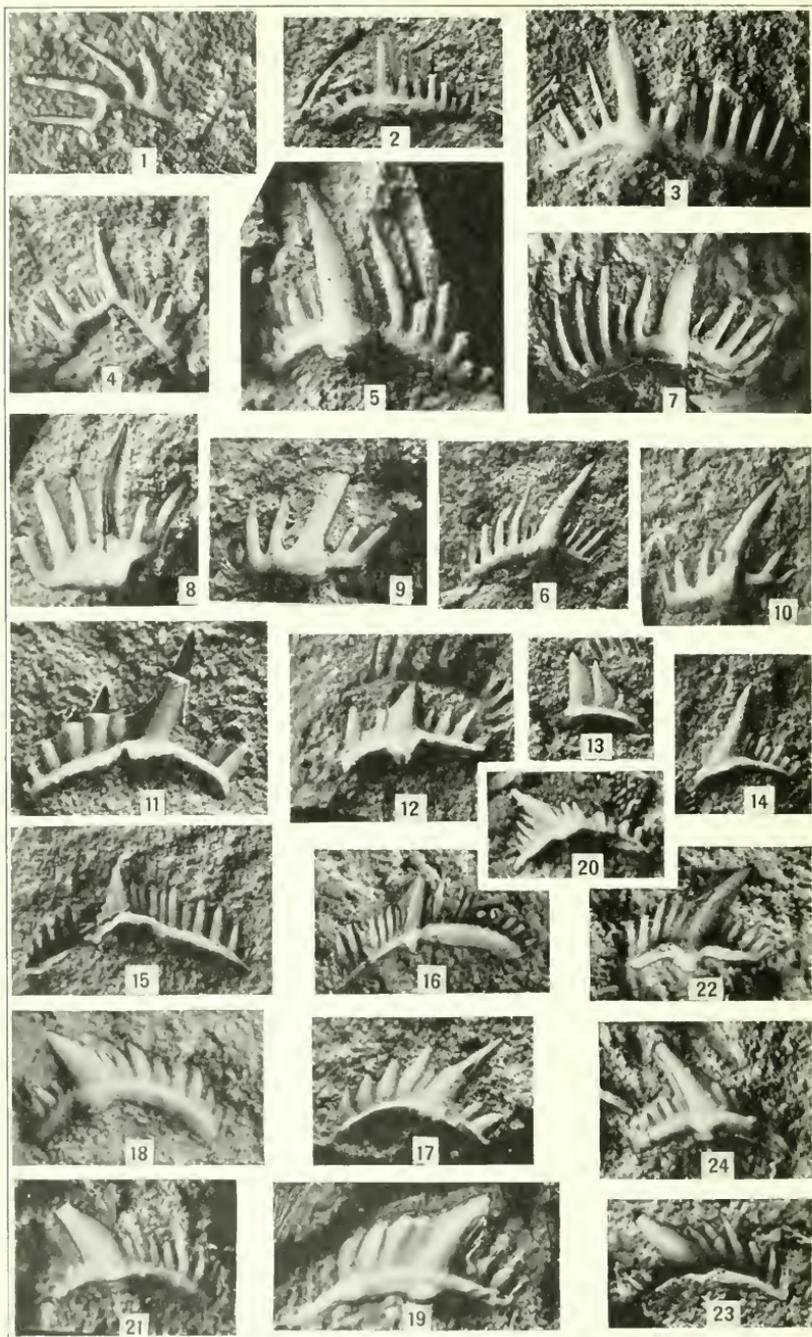
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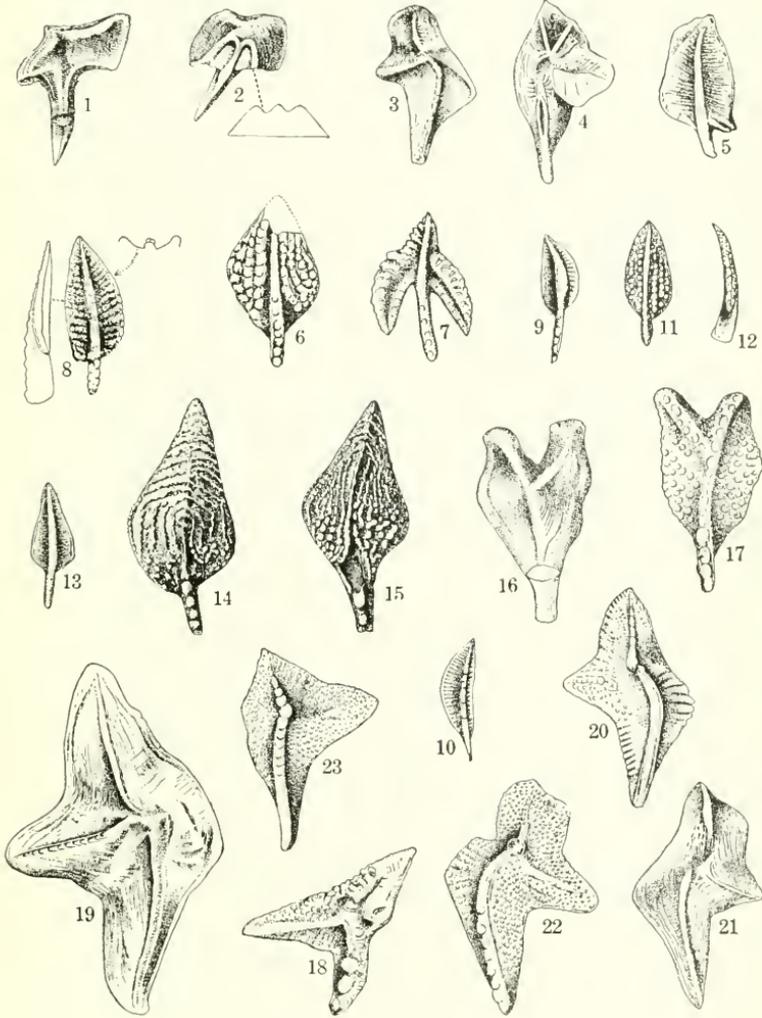
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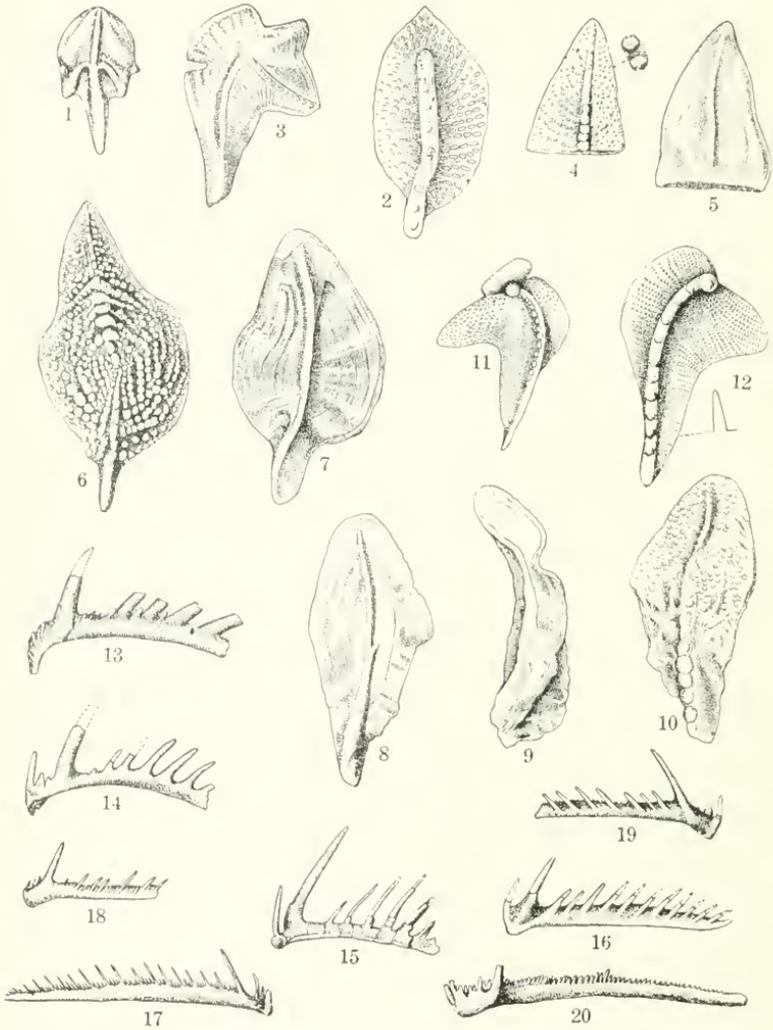
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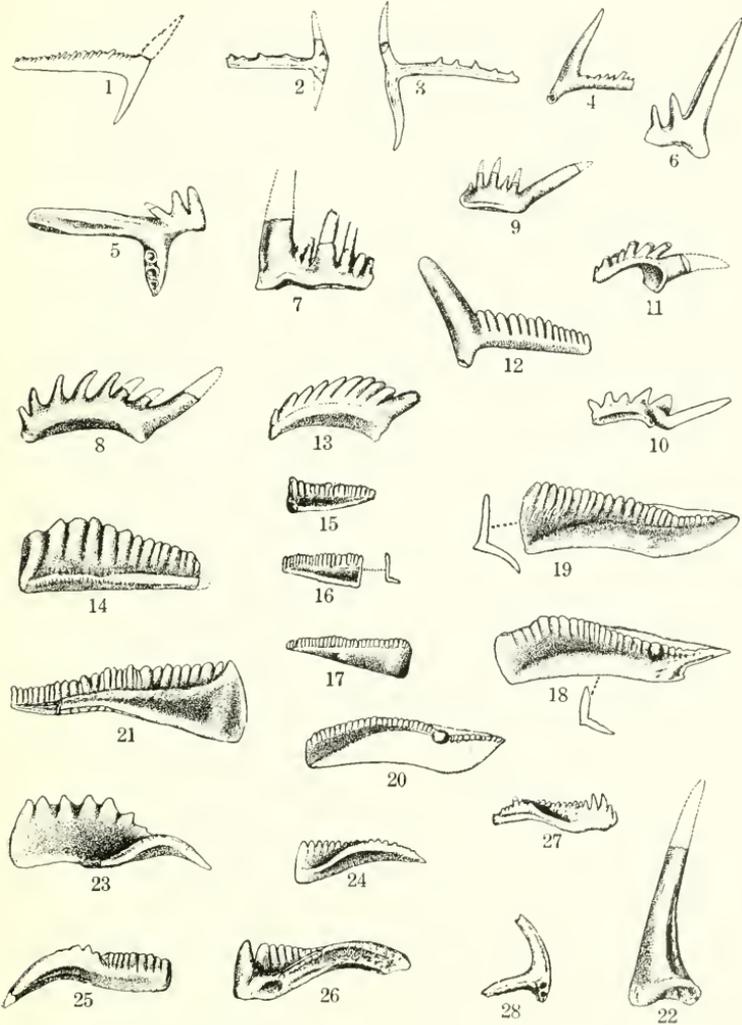
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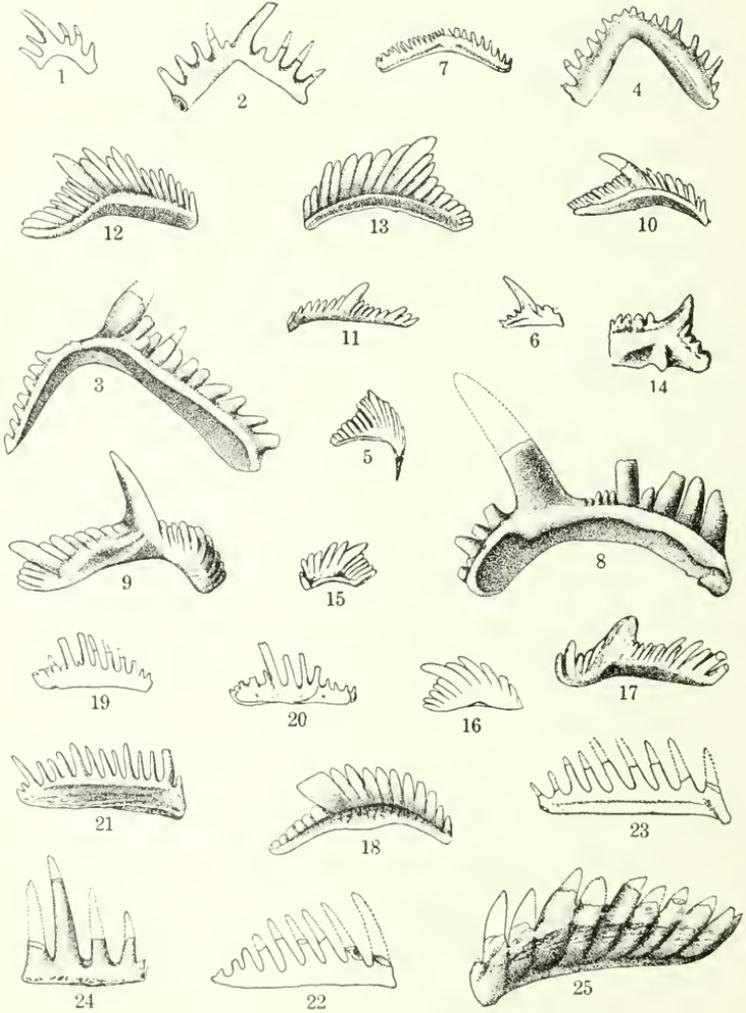
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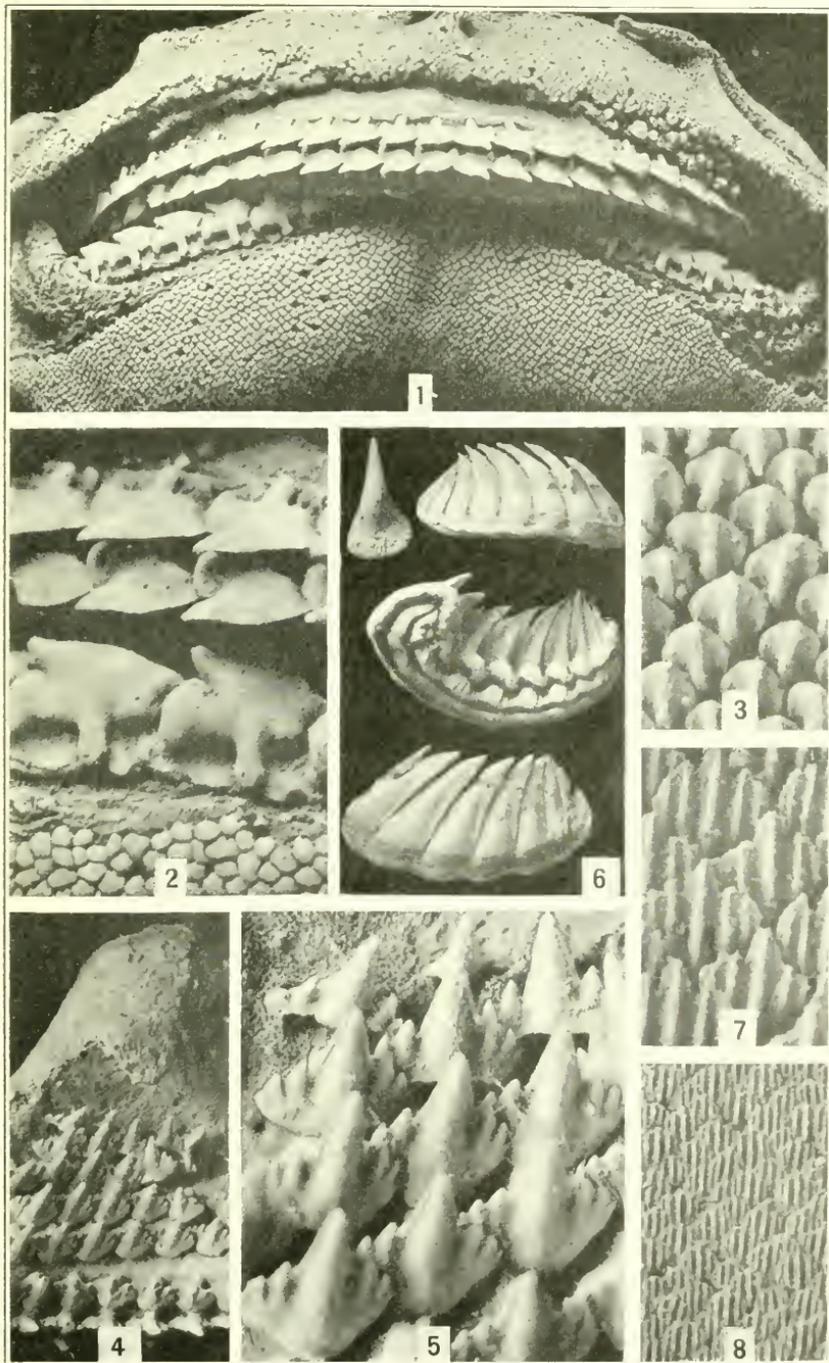
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FOR EXPLANATION OF PLATE SEE PAGES 61 AND 62



AMERICAN MISSISSIPPIAN CONODONTS

FOR EXPLANATION OF PLATE SEE PAGES 62 AND 63



TEETH AND DERMAL PLATES OF RECENT FISHES

FOR EXPLANATION OF PLATE SEE PAGE 63

