

ABSTRACT

Thirty-five species and subspecies of disjunct conodonts are described and figured from the Devonian Buchan Group in eastern Victoria. Seven new species and subspecies are proposed. The fauna, in comparison with known European Lower Devonian conodont faunas, suggests a Lower Emsian age for the Murrindal Limestone at the top of the Buchan Group.

Lower Devonian conodonts from the Buchan Group, eastern Victoria

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INTRODUCTION

The Buchan Group, in eastern Victoria, is the most important Devonian limestone succession in that state and one of the better-known marine Devonian sequences in southeastern Australia. Since its discovery in the middle part of the last century, the Buchan Group has been considered to be of lower Middle Devonian age (McCoy, 1867), and this interpretation has profoundly influenced ideas on Devonian correlations in eastern Australia.

Conodonts recovered from eight localities through the sequence are described in this paper. These conodonts, in comparison with known European faunas, suggest a Lower Devonian age for the sequence. This has been mentioned in a preliminary note on the fauna given elsewhere (Philip and Pedder, 1964).

ACKNOWLEDGEMENTS

This paper gives the results of part of the work on the sequence of Devonian conodont faunas in eastern Australia, which in turn is an aspect of a project on Australian Devonian biostratigraphy, generously supported by University of New England Research Grant No. 120. I am greatly indebted to Dr. O. H. Walliser of Philipps-Universität, Marburg an der Lahn, West Germany, who commented on the conodont identifications.

STRATIGRAPHY

The stratigraphy of the Buchan Group has been described by Teichert (1948, 1959), who mapped the sequence and erected currently used stratigraphic units. The group consists of some 3,000 feet of fossiliferous limestones and mudstones, resting with apparent conformity on an underlying sequence of acid volcanics, the Snowy River Volcanics. The marine Devonian strata comprise a basal limestone unit (the Buchan Caves Limestone) overlain by fawn-colored mudstones and nodular limestones (the Taravale Formation),

which to the north grade laterally into well-bedded and massive limestones (the Murrindal Formation). This is shown in the locality map (text-figure 1) and the generalised N-S section (text-figure 2), which gives the stratigraphic position of the localities. Some slight modifications of Teichert's work have been introduced in these figures and are discussed below in turn.

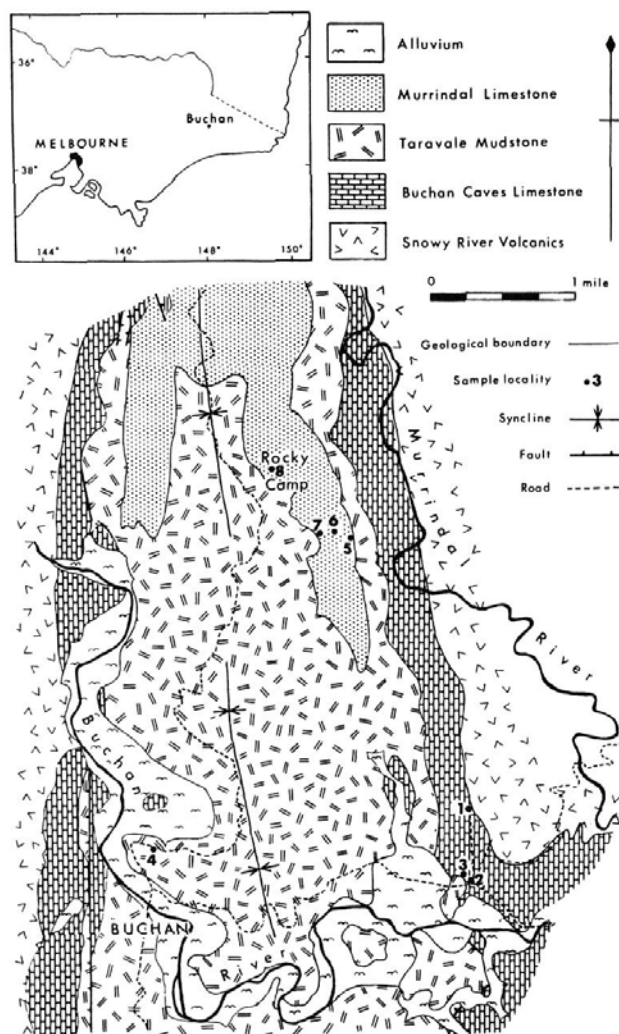
1) In the northern part of the area shown in text-figure 1, a prominent tongue of the Taravale Formation occurs between the Buchan Caves Limestone and the Murrindal Limestone. This was designated the Pyramids Mudstone Member (of the Taravale Formation) by Teichert. However, this tongue cannot be distinguished lithologically from the Taravale Formation, so, in accordance with current Australian stratigraphic practice, the unit has not been used.

2) Teichert (1959) divided the Murrindal Limestone into two members, the McLarty Member, typically bedded limestones, and the Rocky Camp Member, more massive biohermal limestones. Recent re-investigation of the stratigraphy of the Buchan district by the writer and A. E. H. Pedder has shown that this subdivision, as used by Teichert, cannot be upheld. Consequently, the units have not been employed in text-figures 1 and 2.

3) The persistent biostromal horizon in the middle part of the Murrindal Limestone, referred to as the "*Amphipora* zone" (Teichert, *op. cit.*, pl. 5, fig. 2), is made up of digitate calcareous algae (Philip, 1960, p. 153), so it is referred to as an algal biostrome in text-figure 2.

METHOD OF STUDY

Details of laboratory procedures employed have been given elsewhere (Philip, 1965). All photographed specimens are registered in the Palaeontological Collection of the University of New England, Armidale, New South Wales.



TEXT-FIGURE 1

Locality map of the Buchan district.

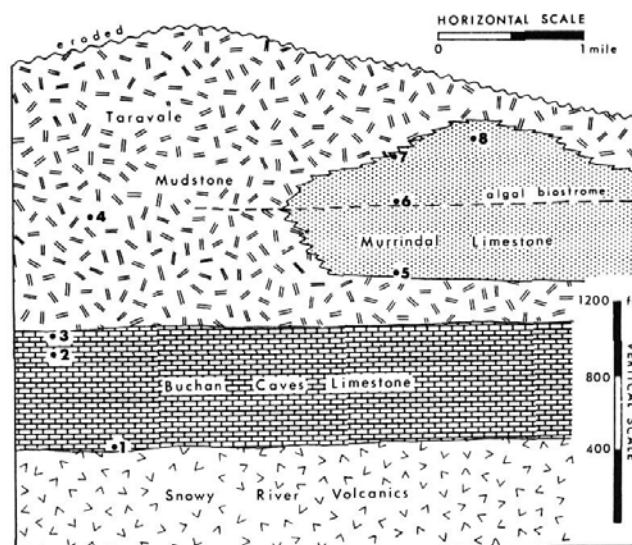
LOCALITIES AND YIELDS

Locality 1: Base of Buchan Caves Limestone, Moons Road, near Teichert (1959) locality 79. First limestone exposed on roadside above Snowy River Volcanics. Amount processed: 6 kg. Yield: 1 specimen.

Locality 2: Buchan Caves Limestone, 30 yards west of road intersection. Amount processed: 9 kg. Yield: 32 specimens.

Locality 3: Top 10 feet of Buchan Caves Limestone, 100 yards west of road intersection. Amount processed: 20 kg. Yield: ca. 750 specimens. Acid insoluble residues yielded abundant scolecodonts, apparently the first recorded from Australia.

Locality 4: *Teicherticeras* horizon, middle of Taravale Mudstone, road cutting 660 yards north of bridge over Buchan River, Teichert (1959) locality 167. Amount processed: ca. 1 kg. Because of the muddy nature of the



TEXT-FIGURE 2

Generalized north-south section through the Buchan Group (after Teichert, 1959, pl. 5, fig. 2).

nodular limestone, very little of the sample dissolved in acetic acid. The amount processed is therefore only an estimate. Yield: 4 specimens.

Locality 5: Base of Murrindal Limestone, McLarty's Ridge. Amount processed: 12 kg. Yield: 28 specimens.

Locality 6: Middle of Murrindal Limestone, McLarty's Ridge. Sample collected over a 30-foot stratigraphic interval in and stratigraphically above the algal biostrone. Amount processed: 9 kg. Yield: ca. 1200 specimens. This sample provided a greater abundance of conodonts than any other from the Buchan Group.

Locality 7: Top of Murrindal Limestone, McLarty's Ridge. Amount processed: 12 kg. Yield: 30 specimens.

Locality 8: Upper part of Murrindal Limestone, Rocky Camp. Amount processed: 10 kg. Yield: ca. 100 specimens.

COMPOSITION AND STRATIGRAPHIC SIGNIFICANCE OF CONODONT FAUNA

For nearly a century the Buchan Group has been regarded as Middle Devonian in age. Philip and Pedder (1964) have pointed out, however, that this notion is poorly founded. The most important information yet brought to bear on the age of the sequence was provided by Teichert (1948), who described a small cephalopod fauna which he took as indicative of an Eifelian age. However, subsequent work on Lower Devonian cephalopods of Europe (Erben, 1953, 1960) has modified this determination, for the occurrence of *Teicherticeras* now must be taken as favouring an Emsian age for the Taravale Mudstone. No compelling evidence has yet been adduced from other macrofossil groups which runs counter to this conclusion.

LOWER DEVONIAN CONODONTS

Knowledge of the sequence of Lower Devonian conodonts in Europe derives principally from the work of Bischoff and Sannemann (1958), Jentsch (1962), Walliser (1962, 1964) and Ziegler (1956, 1960). Walliser has summarised available information and has proposed a zonal scheme of faunas, which in part is based on otherwise unpublished information obtained from Lower Devonian sections in the Carnic Alps.

Taken as a whole, the Buchan conodont fauna presents these differences from described European faunas:

1) Abundance of belodontids and distacodontids. These are a numerically significant part of the Buchan conodont fauna. Although it has been suggested by some workers that the occurrence of simple conodonts in Devonian faunas is indicative of stratigraphic admixture, they constitute an important element of all Australian Lower Devonian faunas so far examined. As these faunas have been recovered from geographically widely separated localities in different geological settings, simple conodonts are considered to be an integral part of Australian Lower Devonian faunas.

2) Absence of representatives of the genus *Icriodus*. The studies of Ziegler (1956) and Bischoff and Sannemann (1958) indicate the great abundance and variety of forms of *Icriodus* in the Lower Devonian of Europe. No forms referable to *Icriodus* were recovered in the Buchan fauna, and only a single specimen of *Icriodus latericrescens* (*sensu* Ziegler) was obtained from another Lower Devonian limestone (Philip, 1965). Such a dearth of specimens of *Icriodus* appears to be a general characteristic of Australian Lower Devonian conodont faunas.

In terms of Walliser's sequence of European Lower Devonian conodonts, close limits can be assigned to the age of the Murrindal Limestone.

Ozarkodina denckmanni and *Spathognathodus steinhornensis* first appear in the late Silurian and range through to the end of the Lower Devonian. (The question of the Silurian-Devonian boundary is at present under review. For present purposes, consistent with accustomed usage, the base of the Devonian is taken as the base of the Gedinian, *i. e.*, approximately at the base of the Lockovian and the zone of *Monograptus uniformis* in the Central European sections (*vide* Jaeger, 1962).) However, several other species which also first appear in the Silurian extend only to the top of the Lower Emsian. These include *Hindeodella equidentata*, *Ozarkodina media*, *Plectrospathodus extensus*, *Spathognathodus inclinatus*, *Trichonodella excavata* and *Trichonodella inconstans*.

The overlap of these species with *Polygnathus linguiformis*, which apparently enters the Buchan sequence at the base of the Murrindal Limestone, is of particular interest. According to Ziegler (1956), *Polygnathus linguiformis* appears toward the top of the Lower Emsian (the Schönauer-Kalk) in the Kellerwald. Walliser (1962), however, extends its range downward to the base of

TABLE 1

DISTRIBUTION OF CONODONTS IN BUCHAN GROUP

Species	Locality	1	2	3	4	5	6	7	8
<i>Belodella</i> sp. cf. <i>B. devonica</i> (Stauffer)									
<i>Belodella resima</i> (Philip)		+	+			+	+	+	+
<i>Belodella triangularis</i> (Stauffer)			+			+	+	+	+
<i>Drepanodus</i> sp. A									
<i>Drepanodus</i> sp. B									
<i>Eognathodus linearis</i> n. sp.				+					
<i>Hindeodella equidentata</i> Rhodes						+			
<i>Hindeodella priscilla</i> Stauffer		+	+			+			+
<i>Hindeodella</i> sp. A							+		
<i>Hindeodella</i> sp. B									+
<i>Lonchodina murrindalensis</i> n. sp.							+		
<i>Lonchodina</i> n. sp.				+					
<i>Neoproniodus bicurvatus</i> (Branson and Mehl)		+	+				+	+	+
<i>Ozarkodina denckmanni</i> Ziegler		+	+			+	+	+	+
<i>Ozarkodina</i> sp. cf. <i>O. jaegeri</i> Walliser		+	+						
<i>Ozarkodina media</i> Walliser							+		
<i>Ozarkodina?</i> sp.				+					
<i>Panderodus acostatus</i> (Branson and Branson)						+	+		+
<i>Panderodus</i> sp. cf. <i>P. recurvatus</i> (Rhodes)				+					
<i>Panderodus unicostatus</i> (Branson and Mehl)							+	+	
<i>Panderodus valgius</i> (Philip)				+			+	+	+
<i>Plectrospathodus alternatus</i> Walliser			+	+					
<i>Plectrospathodus extensus lacertus</i> n. subsp.							+	+	
<i>Polygnathus linguiformis</i> Hinde						+	+	+	+
<i>Roundya perbona</i> n. sp.							+	+	
<i>Spathognathodus exiguus</i> n. sp.							+	+	
<i>Spathognathodus inclinatus inclinatus</i> (Rhodes)							+	+	
<i>Spathognathodus steinhornensis buchanensis</i> n. subsp.		+	+	+			+		+
<i>Spathognathodus</i> sp.			+						
<i>Trichonodella excavata</i> (Branson and Mehl)							+		
<i>Trichonodella inconstans</i> (Walliser)			+	+					
<i>Trichonodella</i> sp. cf. <i>T. inconstans</i> (Walliser)		+					+		
<i>Trichonodella symmetrica pinnula</i> n. subsp.				+					
<i>Trichonodella</i> sp.				+					
Genus and species not determined									+

the Lower Emsian. Its occurrence at Buchan, in association with the species listed above, therefore indicates a Lower Emsian age for the Murrindal Limestone. If the entry of *Polygnathus* can be taken as the base of the Emsian in the Buchan Group, then the Buchan Caves Limestone is of youngest Siegenian age.

It is concluded, therefore, that the conodont fauna of the upper part of the Buchan sequence (the Murrindal Limestone), in terms of present knowledge of the distribution of conodonts in Devonian strata in Europe, indicates a Lower Emsian age. This conclusion is strongly reinforced by current work on Devonian regional correlations in Victoria and New South Wales (to be published elsewhere), which has shown that younger Lower Devonian (*i. e.*, Upper Emsian) strata are present in the Murrumbidgee sequence in southern New South Wales and in the Tamworth Group in northern New South Wales.

SYSTEMATIC DESCRIPTIONS

Genus *Belodella* Ethington, 1959

Type species: Belodus devonicus Stauffer, 1940.

Remarks: Ethington (1959) proposed this genus for Devonian forms previously referred to *Belodus*, but which are distinguished by the closer denticulation of the posterior margin and by the very deep basal cavity. Jordan (1960) has suggested that *Belodella* is a scolecodont, but the Australian material does not support this interpretation.

Belodella sp. cf. *B. devonica* (Stauffer)

Plate 1, figures 22–24

cf. *Belodus devonicus* STAUFFER, 1940, p. 420, pl. 59, figs. 47–48.
cf. *Belodella devonica* (Stauffer). – ETHINGTON, 1959, pp. 271–272.

Figured specimens: 8847/16; 8849/13–14.

Remarks: The Buchan specimens differ from Stauffer's species in the denticles of the posterior edge which tend to be larger, far less numerous, and discrete instead of fused. Close relationship with *B. devonica* is indicated by the biconvex cross section of the basal cavity.

Belodella resima (Philip)

Plate 1, figures 14–17

Belodus resimus PHILIP, 1965, pp. 98–99, pl. 8, figs. 15–17, 19; text-fig. 2c–f.

Diagnosis: A species of *Belodella* in which the deep basal cavity is narrowly triangular in cross section. Junctions of anterior and lateral faces marked by costae; denticles of posterior edge numerous and fused.

Figured specimens: 8847/21; 8849/4–5, 15.

Remarks: The specimen illustrated by Rhodes and Dineley (1957, pl. 37, fig. 3) from the Devonian of England as *Belodus* cf. *B. devonicus* Stauffer closely resembles *B. resima*, but in *B. devonicus* the anterior margin is strongly keeled.

Belodella triangularis (Stauffer)

Plate 1, figures 20–21

Belodus triangularis STAUFFER, 1940, p. 420, pl. 59, fig. 49. – RHODES and DINELEY, 1957, p. 358, pl. 37, figs. 1–2 (? not fig. 3).

Belodella triangularis (Stauffer). – ETHINGTON, 1959, pp. 271–272.

Belodus cf. *triangularis* Stauffer. – PHILIP, 1965, p. 99, pl. 8, figs. 22, 26–28; text-fig. 2c–d.

Not *Belodus triangularis* Stauffer. – JENTZSCH, 1962, p. 964, pl. 1, figs. 2–3.

Diagnosis: A species of *Belodella* in which the deep basal cavity is strongly triangular in cross section. Junctions of lateral and anterior faces marked by ridges; numerous small denticles along the posterior edge.

Figured specimens: 8847/15; 8849/7.

Remarks: Although Stauffer's original figure is of a broken specimen, there can be little doubt that all the above listed forms are conspecific. However, the specimens figured by Jentzsch (*loc. cit.*) are of a long thin tapering form which appears to be quite unlike *B. triangularis*.

Genus *DREPANODUS* Pander, 1856

Drepanodus sp. A

Plate 1, figures 4–5

Figured specimens: 8847/19–20.

Remarks: This species is characterised by the rounded outline of the basal cavity and the ovate cross section of the cusp.

Drepanodus sp. B

Plate 1, figures 6–7

Figured specimens: 8847/17–18.

Remarks: This is a flattened species of *Drepanodus* in which the cusp is straight and erect. The cross section of the cusp is narrowly biconvex, with sharp anterior and posterior edges. As with *Drepanodus* sp. A, no close comparison with previously described Silurian or Devonian species of *Drepanodus* can be suggested.

Genus *Eognathodus* Philip, 1965

Type species: *Eognathodus sulcatus* Philip, 1965.

Remarks: *Eognathodus* was proposed for early Devonian platformed conodonts with a widely expanded and flaring basal cavity located at the posterior end of the unit. In the type species the oral surface is ornamented by two lateral series of irregular nodes which merge with a denticulate anterior blade. In a second species, *E. secus*, the ornament of the oral surface is of irregularly disposed nodes. Therefore, as originally conceived, the genus included forms resembling the Carboniferous genera *Gnathodus* or *Streptognathus*.

The inclusion of *E. linearis*, n. sp., in *Eognathodus* changes the concept of the genus. This species is essentially a bladed form, although in other respects it is closely comparable with *E. sulcatus*. *Eognathodus*, therefore, intergrades with *Spathognathodus*, from which it differs in the degree of development of the basal cavity, and in its posterior location.

Walliser (1964) has described two European Upper Silurian species, *Spathognathodus snajdri* and *S. crispus*, which also may be included in *Eognathodus*. Other Silurian species of *Spathognathodus* may have the basal cavity at the posterior end of the unit, but in these the basal cavity is not so widely flaring.

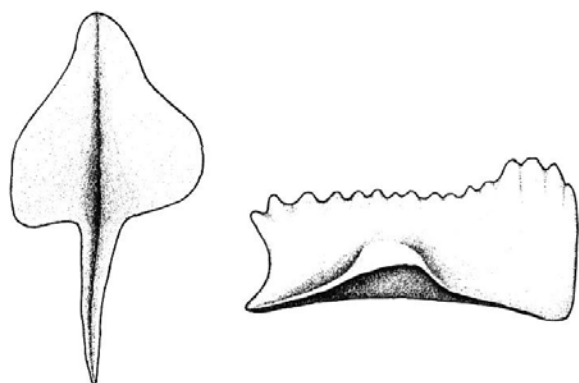
Eognathodus linearis Philip, new species

Plate 4, figures 33–36; text-figure 3

Name: From the Latin *linearis*, of a line.

Diagnosis: A bladed species of *Eognathodus* with the oral margin above the basal cavity ornamented with separated nodes; anterior blade high and regularly denticulated; in mature specimens posterior end overhanging.

Figured specimens: Holotype, 8845/7; 8845/8.



TEXT-FIGURE 3

Aboral and lateral aspects of *Eognathodus linearis* Philip, n. sp.,
× 35.

Description: The unit is straight with the widely expanded basal cavity reaching half way to the anterior end. In mature specimens the regularly denticulate blade is high anteriorly and tapers downward to above the anterior margins of the basal cavity. Above the basal cavity the oral margin of the blade is ornamented with rounded, well-spaced nodes which become larger and more backwardly directed toward the posterior end. The posterior margin is bowed inwards. The basal cavity has widely flaring lobes expanding outwards from the posterior end so that they reach their greatest width toward their rounded margins. The aboral surface is marked by a medial groove which runs the entire length of the unit.

Remarks: Amongst previously described conodonts, *E. linearis* resembles most closely the Silurian species *Spathognathodus snajdri* Walliser (1964, p. 84, pl. 9, fig. 2; pl. 21, figs. 14–15; pl. 22, figs. 1–4). *E. linearis* differs in its squatter form, its coarser denticulation, and its higher anterior blade.

Genus *Hindeodella* Bassler, 1925

Type species: *Hindeodella subtilis* Bassler, 1925.

Remarks: Four forms of *Hindeodella* appear to be present in the Buchan material. However, the specimens are mostly broken, and do not permit confident speciation. For completeness the different types are briefly described and figured.

Hindeodella equidentata Rhodes Plate 3, figure 1

Hindeodella equidentata RHODES 1953, p. 303, pl. 23, figs. 248, 252–254.

Hindeodella affin. *equidentata* Rhodes. – BISCHOFF and SANNE-MANN, 1958, p. 94, pl. 15, fig. 2.

Hindeodella cf. *H. equidentata* Rhodes. – WALLISER, 1960, p. 30, pl. 8, fig. 15.

Diagnosis: A massive species of *Hindeodella* with a thick, deep bar and discrete denticles which generally lack alternate series of smaller denticles. Anterior bar short and inwardly bowed at an angle of 90°–120° to the posterior bar; a groove along the underside of the posterior bar is expanded slightly beneath the cusp to form the small basal cavity.

Figured specimen: 8850/28.

Remarks: The specimens from Buchan, as well as those described elsewhere (Philip, 1965) from the early Devonian Coopers Creek Formation of Gippsland, tend to have smaller denticles interposed between the larger denticles of the posterior bar. The specimen illustrated as *H. affin. equidentata* by Bischoff and Sannemann (*loc. cit.*) also shows this feature. It follows that some separation of the stratigraphically younger forms of the species may prove possible. The specimen illustrated in plate 3, figure 7 appears to be intermediate between *H. equidentata* and *H. priscilla*.

Hindeodella priscilla Stauffer Plate 3, figures 2, 6–9, 11, 18

Hindeodella priscilla STAUFFER, 1938, p. 429, pl. 50, fig. 6.

Hindeodella lambtonensis STAUFFER, 1938, p. 428, pl. 50, figs. 2, 5, 8, 13–14, 17, 20, 25, 28, 31.

Hindeodella milleri STAUFFER, 1938, p. 428, pl. 50, figs. 3–4, 9–11.

Hindeodella moweri STAUFFER, 1940, p. 424, pl. 58, figs. 2, 10–11.

Hindeodella n. sp. WALLISER, 1960, p. 30, pl. 8, fig. 6.

Diagnosis: A thin, moderately large species of *Hindeodella* with a long posterior bar, and a short, gently deflected anterior bar (which may be somewhat downwardly flexed) with usually discrete denticles. Posterior denticles hindeodellid, becoming larger posteriorly. Cusp rounded in cross section, inclined and curved posteriorly; basal cavity small.

Figured specimens: 8844/3; 8845/1, 23; 8847/9–12.

Remarks: The forms included in this species vary considerably in the depth of the unit and the character of the anterior limb. One specimen (plate 3, figure 11) shows a distinct downward flexure of the posterior limb, similar to that illustrated by Bischoff and Ziegler (1957, pl. 7, fig. 4) in a Middle Devonian specimen of the species.

Hindeodella sp. A Plate 3, figure 4

Figured specimen: 8847/13.

Remarks: This species possesses a coarsely denticulated posterior bar which narrows anteriorly beneath a tiny cusp no longer than the enlarged denticles. The anterior bar is short. The form therefore to some extent resembles *Hindeodella catacta* Huddle (1934, p. 40, pl. 4, fig. 18).



TEXT-FIGURE 4

Oral and lateral aspects of *Lonchodina murrindalensis* Philip, n. sp., $\times 50$.

Hindeodella sp. B
Plate 3, figure 5

Figured specimen: 8849/10.

Remarks: This species is distinguished by the irregular denticulation and the short, downwardly flexed anterior bar. It resembles *Hindeodella deflecta* Hibbard (Huddle, 1934, pp. 44–45, pl. 4, fig. 15) but differs in the shorter posterior bar and cusp. The posterior bar of *H. adunca* Bischoff and Ziegler (1957, pl. 7, fig. 10) may be similar, but that species has a long anterior bar which is flexed inwards.

Genus LONCHODINA Bassler, 1925

Lonchodina murrindalensis Philip, new species
Plate 4, figures 9–14; text-figure 4

Name: Derived from Murrindal, several miles north of Buchan.

Diagnosis: A twisted species of *Lonchodina* with very short anterior and posterior limbs. Aboral surface excavated beneath cusp and posterior limb.

Figured specimens: Holotype, 8850/32; 8850/33.

Description: Unit with short, strongly twisted limbs, the anterior one of which is shorter and deeper than the posterior. Anterior limb usually has four closely spaced denticles which increase in size to the cusp. Posterior limb usually with six smaller denticles which tend to increase in size distally. Cusp and denticles of the anterior limb are flattened on the inner side. Aboral surface excavated beneath the cusp to form the basal cavity, which is continued as a groove beneath the posterior limb.

Remarks: This species resembles most closely *Lonchodina walliseri* Ziegler (Walliser, 1964, pp. 44–45, pl. 30, figs. 26–33), from which it is distinguished by the shorter limbs and larger anterior denticles. It is possible that the species is derived from *L. walliseri* and should be regarded as a subspecies of that form.

Lonchodina n. sp.
Plate 3, figures 19–20, 24

Figured specimens: 8847/27–28; 8850/29.

Remarks: This is an arched barlike species of *Lonchodina* with a comparatively small cusp and cylindrical discrete

denticles on the anterior and posterior limbs. These denticles are irregular in size, and one or more of those of the posterior limb may be enlarged. Both the anterior and posterior limbs tend to become flattened distally, so that the distal denticles may likewise be flattened.

This form apparently represents a new species which closely resembles the specimen illustrated as *Lonchodina* cf. *L. disjuncta* Stauffer by Rhodes and Dineley (1957, pl. 37, fig. 16). In *L. disjuncta* (= *Lonchodina discreta* Ulrich and Bassler) the unit is apparently more twisted and the denticles larger and more regular (Bischoff and Ziegler, 1957, pl. 10, figs. 9, 11–13). As only three specimens of this new species have been recovered, and as these show considerable variation, the naming of the form is deferred until more material comes to hand.

Genus NEOPRIONIODUS Rhodes and Müller, 1956

Neoprioniodus bicurvatus (Branson and Mehl)
Plate 3, figures 12–16

Prioniodus bicurvatus BRANSON and MEHL, 1933, p. 44, pl. 3, figs. 9–12.

Prioniodina tropa (Stauffer). – ZIEGLER, 1956, p. 104, pl. 16, fig. 29; pl. 27, fig. 29 (not *Synprioniodina tropa* Stauffer, 1940).

Prioniodina, n. sp. ZIEGLER, 1960, p. 193, pl. 16, fig. 23.

Prioniodina bicurvata pronoides WALLISER, 1960, p. 33, pl. 8, figs. 8–11.

Neoprioniodus sp. ETHINGTON and FURNISH, 1962, p. 1275, pl. 173, fig. 3.

Neoprioniodus bicurvatus (Branson and Mehl). – WALLISER, 1964, p. 46, pl. 9, fig. 13; pl. 29, figs. 27–33; text-fig. 1.

Not *Prioniodina bicurvata* (Branson and Mehl). – WALLISER, 1957, p. 46, pl. 2, figs. 18–19. – KOCKEL, 1958, pp. 258–259. – BISCHOFF and SANNEMANN, 1958, p. 102, pl. 15, figs. 6, 12. – ETHINGTON and FURNISH, 1962, p. 1283, pl. 173, fig. 17. – WALLISER, 1962, p. 283, fig. 1 (17).

Diagnosis: A species of *Neoprioniodus* with closely spaced denticles which are forwardly directed relative to the base of the posterior bar. Cusp enlarged, with a flattened outer surface. Aboral surface of posterior bar usually with a longitudinal groove which expands to give a well-defined basal cavity beneath the cusp; anti-cusp is small and may bear a few tiny denticles.

Figured specimens: 8845/30–32; 8850/30–31.

Remarks: Some confusion exists as to the identification of the common Silurian and Lower Devonian species *Neoprioniodus bicurvatus* and *N. excavatus* (Branson and Mehl). Walliser's (1964) interpretation has been followed here.

Genus OZARKODINA Branson and Mehl, 1933

Ozarkodina denckmanni Ziegler
Plate 4, figures 15–20

Ozarkodina denckmanni ZIEGLER, 1956, p. 103, pl. 6, figs. 30–31; pl. 7, figs. 1–2.

Ozarkodina typica denckmanni Ziegler. – WALLISER, 1964, p. 61, pl. 9, fig. 14; pl. 16, figs. 3–11.

LOWER DEVONIAN CONODONTS

Diagnosis: A flattened species of *Ozarkodina* with small expanded lips on each side of the basal cavity. Cusp and denticles with strong backward inclination, distinctly flattened and with occasional germ denticles interposed. Anterior limb usually slightly longer than posterior, with denticles generally increasing in size to the cusp; denticles of posterior limb smaller, more numerous, and more uniform in height, but also becoming smaller distally.

Figured specimens: 8845/3-4; 8849/1-3; 8850/4.

Remarks: Walliser (1964) has noted the close resemblance between this form and *O. typica* Branson and Mehl, and has described forms transitional between the two species from the Upper Silurian of Bohemia. As a consequence, he regards *O. denckmanni* as a subspecies of *O. typica*.

Ozarkodina media Walliser Plate 1, figures 29, 32-33

Ozarkodina sp. RHODES, 1953, pl. 23, fig. 244.

Ozarkodina media WALLISER, 1957, p. 40, pl. 1, figs. 21-25.

Ozarkodina cf. *media* Walliser. - PHILIP and PEDDER, 1964, p. 1324.

Diagnosis: A species of *Ozarkodina* with limbs of approximately equal length, usually somewhat arched at an angle greater than 120°. Anterior limb generally deeper than posterior limb and carrying somewhat larger denticles. Enlarged cusp and denticles laterally flattened and basally crowded. Basal cavity wide, with flaring lips (which may be somewhat asymmetrical), continued beneath each limb as a groove.

Figured specimens: 8847/1-3.

Remarks: The Buchan specimens tend to have somewhat larger denticles than are typical, but they fall within the range of variation of the species.

Ozarkodina sp. cf. *O. jaegeri* Walliser Plate 4, figures 31-32

cf. *Ozarkodina jaegeri* WALLISER, 1964, pp. 57-58, pl. 9, fig. 16; pl. 25, figs. 11-18; text-fig. 3n-o.

Figured specimens: 8845/5-6.

Remarks: The two available complete specimens of this form from the top of the Buchan Caves Limestone apparently fall within the range of *O. jaegeri* as described and illustrated by Walliser (*loc. cit.*). However, the posterior limb appears to be slightly shorter than is typical of that species. In Europe *O. jaegeri* is confined to correlatives of $e\beta_2$ of the Bohemian sequence, *i. e.*, the highest pre-Gedinnian strata. The Buchan specimens are therefore only compared with Walliser's species, as additional material could well show consistent differences from it.

In general aspect *O. zieglerei* Walliser is a similar species, but in that form the limbs tend to be twisted.

Ozarkodina? sp.

Plate 4, figure 28

Figured specimen: 8845/29.

Remarks: This is a strongly arched unit, with the denticles of the limbs discrete. The underside of the unit is excavated. As the limbs are not twisted, the form is questionably referred to *Ozarkodina*. Only one specimen of this form was recovered.

Genus *Panderodus* Ethington, 1959

Type species: *Paltodus unicostatus* Branson and Mehl, 1933.

Remarks: Ethington (1959) has restricted the genus *Paltodus* to Lower Ordovician species with shallow basal cavities, and proposed the genus *Panderodus* for forms with deep basal cavities which also occur in younger strata. Some workers (*e. g.*, Hass, 1962) have not recognized this division of the genus, but it seems that the separation is of value.

Panderodus acostatus (Branson and Branson) Plate 1, figures 13, 18

Paltodus acostatus BRANSON and BRANSON, 1947, p. 554, pl. 82, figs. 1-5, 23-24.

Paltodus cf. *P. acostatus* Branson and Branson. - WALLISER, 1960, p. 31, pl. 7, fig. 10.

Panderodus acostatus (Branson and Branson). - CLARK and ETHINGTON, 1964, p. 679.

Diagnosis: A species of *Panderodus* with the cusp gently recurved. Anterior edge gently rounded and somewhat flat; posterior edge more narrowly rounded and produced as a keel which narrows and fades distally. Lateral faces rounded.

Figured specimens: 8847/28-29.

Panderodus sp. cf. *P. recurvatus* (Rhodes) Plate 1, figures 8-9

cf. *Paltodus recurvatus* RHODES, 1953, p. 297, pl. 23, figs. 219-220.

Paltodus cf. *P. recurvatus* Rhodes. - WALLISER, 1957, p. 42, pl. 2, figs. 2-4.

cf. *Panderodus recurvatus* (Rhodes). - CLARK and ETHINGTON, 1964, p. 679.

Figured specimens: 8847/13-14.

Remarks: This form differs from *P. recurvatus* in possessing a flattened anterior surface which makes definite angles with the lateral faces. In the original description of *P. recurvatus* the anterior margin is given as rounded.

Panderodus unicostatus (Branson and Mehl) Plate 1, figures 10-12, 19

Paltodus unicostatus BRANSON and MEHL, 1933, p. 42, pl. 3, fig. 3.

Paltodus cf. *unicostatus* Branson and Mehl. - WALLISER, 1960, p. 32, pl. 7, fig. 8; text-fig. 10.

Panderodus unicostatus (Branson and Mehl). - ETHINGTON, 1959, p. 284.

Diagnosis: A species of *Panderodus* similar to *P. acostatus* but bearing a longitudinal carina along one lateral face.

Figured specimens: 8847/24–27.

***Panderodus valgus* (Philip)**

Plate 1, figures 1–3

Paltodus valgus PHILIP, 1965, p. 109, pl. 8, figs. 7–8, 12; text-fig. 2b.

Diagnosis: A rapidly expanding species of *Panderodus* with the anterior and posterior edges strongly keeled. One lateral surface is gently convex, whereas the other is strongly arched with a low rounded ridge toward the anterior edge.

Figured specimens: 8847/22–23; 8849/6.

Genus PLECTOSPATHODUS Branson and Mehl, 1933

***Plectospathodus alternatus* Walliser**

Plate 3, figures 10, 17, 21, 25

Plectospathodus cf. *extensus* Rhodes. – ZIEGLER, 1960, p. 191, pl. 15, figs. 6–7.

Sp. indet. a. WALLISER, 1960, p. 35, pl. 7, fig. 14.

Plectospathodus alternatus WALLISER, 1964, p. 64, pl. 9, fig. 17; pl. 30, figs. 23–25.

Diagnosis: A bladed species of *Plectospathodus* with a relatively small, inwardly curved cusp. Basal cavity small and inner lip not prominent. Denticles closely spaced and alternating in size.

Figured specimens: 8845/2, 24–26.

Remarks: This is a particularly distinctive species of *Plectospathodus*, characterized by its *Hindeodella*-like appearance. The Buchan material shows it to be highly variable, particularly in the length of the anterior limb.

***Plectospathodus extensus lacertosus* Philip,
new subspecies**

Plate 1, figures 25–28; text-figure 5

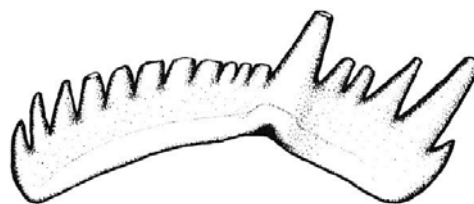
Plectospathodus extensus Rhodes. – PHILIP and PEDDER, 1964, p. 1324.

Name: From the Latin *lacertosus*, strong.

Diagnosis: A strongly arched form of *Plectospathodus extensus* Rhodes (1953, p. 323, pl. 23, figs. 236–240) with a short posterior limb bearing enlarged denticles. Basal cavity on inner side of unit and delimited above by a small lip.

Figured specimens: Holotype, 8850/3; 8850/1–2; 8848/1.

Description: Unit with a deep, flattened posterior limb, and a thicker, shallower anterior limb which is downwardly flexed at an angle between 30° and 50° to the posterior limb. In plan view, anterior limb bowed inwards through an angle of about 30°. Anterior limb almost twice the length of the posterior limb, and



TEXT-FIGURE 5

Inner aspect of *Plectospathodus extensus lacertosus* Philip, n. subsp., × 50.

bearing up to 10 regular discrete denticles, which may be recurved posteriorly. Posterior limb with up to 7 more flattened denticles which are enlarged posteriorly so that one may be larger than the cusp. Basal cavity confined to the region beneath the cusp, mounted on the inner side of the unit, and limited above by a small lip.

Remarks: Ziegler (1960) has noted that Lower Devonian forms of *P. extensus* differ from Silurian forms in that the units are relatively larger, less arched and the denticles are more numerous. The basal cavity also tends to be confined to the lower part of the unit. *P. extensus lacertosus* thus approaches Ludlovian forms of *P. extensus*, from which it differs in being more strongly arched and in possessing a smaller basal cavity. Among previously described conodonts it resembles most closely the Silurian form illustrated as *Plectospathodus* sp. by Walliser (1964, pl. 30, figs. 17, 19).

Genus Polygnathus Hinde, 1879

Type species: *Polygnathus dubia* Hinde, 1879.

Remarks: Ziegler *et al.* (1964) have pointed out that the lectotype of *Polygnathus dubia* Hinde, the legitimate type species of *Polygnathus*, is an indeterminable fragment. As *Polygnathus dubia* is therefore a *nomen dubium*, in order to stabilize the name *Polygnathus*, these writers have petitioned the International Commission on Zoological Nomenclature to annul the designation of *Polygnathus dubia* as type species, and allow the establishment of a new type species. *Polygnathus* is employed here in accordance with accustomed usage.

***Polygnathus linguiformis* Hinde**

Plate 2, figures 29–40

Polygnathus linguiformis HINDE, 1879, p. 367, pl. 17, fig. 15.

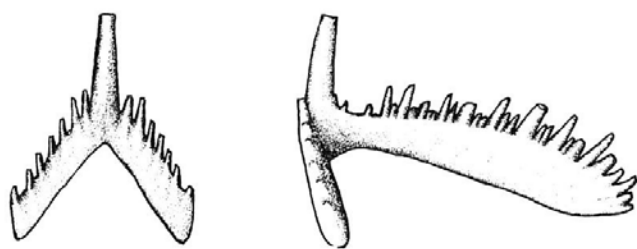
Polygnathus crassus HINDE, 1879, p. 365, pl. 17, fig. 3.

Polygnathus? simplex HINDE, 1879, pp. 367–368, pl. 17, fig. 18.

Polygnathus sanduskiensis STAUFFER, 1938, p. 438, pl. 53, figs. 27, 36–37.

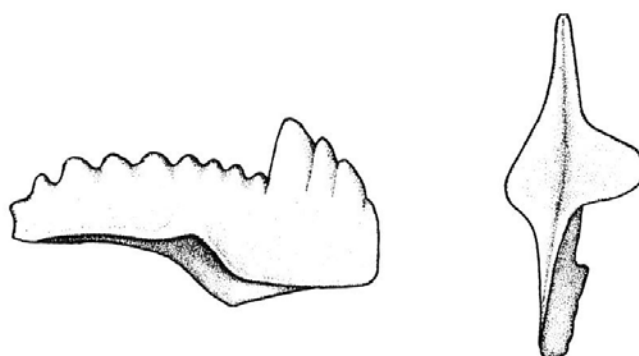
Diagnosis: Platform trough-shaped, with the tapering and flattened posterior end flexed downwards and inwards. Deflected posterior portion of platform bears transverse ridges; anteriorly this ornamentation is con-

LOWER DEVONIAN CONODONTS



TEXT-FIGURE 6

Anterior and lateral aspects of *Roundya perbona* Philip, n. sp., $\times 50$.



TEXT-FIGURE 7

Lateral and aboral aspects of *Spathognathodus exiguus* Philip, n. sp., $\times 50$.

finned to the outer part of the platform, so that adjacent to the carina the oral surface is smooth. Blade high and much shorter than platform, oral surface with fused denticles, highest at anterior end, tapering posteriorly and continued as a row of fused denticles or nodes to the region of flexure of the platform.

Figured specimens: 8846/2; 8847/4-8; 8849/11.

Remarks: The Buchan material differs from typical *Polygnathus linguiformis* in possessing an excavated aboral surface, i. e., an enlarged basal cavity. This is apparently a consistent feature of all material examined, and it seems that in younger Australian Lower Devonian strata this form is replaced by typical *Polygnathus linguiformis*. If this is so, then it would be desirable to recognize the Buchan form as a distinct subspecies of *P. linguiformis*. Dr. O. H. Walliser (*in litt.*, 15 May, 1965), however, observes that in the Lower Devonian of Europe forms with an enlarged basal cavity occur together with forms with a small basal cavity. It therefore seems desirable to leave in abeyance the separation of the Buchan form from *P. linguiformis* s. s. until more information is available concerning other Australian Devonian conodont faunas.

Genus *Roundya* Hass, 1953

Type species: *Roundya barnettana* Hass, 1953.

Remarks: Hass (1953), in proposing this genus, distinguished it from species of *Hibbardella* by the very large basal cavity. Subsequent authors (*e. g.*, Sannemann, 1955; Bischoff and Ziegler, 1957; Ethington and Furnish, 1962) have referred to *Roundya* Devonian species with small basal cavities and even species lacking basal cavities. This procedure has been followed here, but it seems that some confusion exists in the application of these generic names.

Roundya perbona Philip, new species Plate 4, figures 7-8; text-figure 6

Name: Derived from the Latin *perbonus*, very good.

Diagnosis: A species of *Roundya* with a small basal cavity and a long, posteriorly flattened posterior bar with hindeodellid denticulation.

Figured specimens: Holotype, 8850/21; 8846/3.

Description: Cusp slender, circular in outline, and somewhat posteriorly inclined. Two comparatively deep, thick, posteriorly recurved lateral bars originate at the base of the cusp. The aboral margins of the lateral bars diverge at an angle of about 75° . Anterior arch with slender, regular, vertically directed, separated denticles. Posterior bar thick, becoming progressively deeper and more flattened distally. Denticulation hindeodellid (*i. e.*, with enlarged denticles alternating with one or two smaller denticles); denticles progressively reclined distally, so that the most posterior are posteriorly directed. Basal cavity is present as a small triangular pit beneath the cusp, and is continued as a shallow groove a short distance along the underside of the posterior bar.

Remarks: The hindeodellid denticulation of the posterior bar characterizes this species and allies it with the Upper Devonian form *R. aurita* Sannemann (1955, p. 153, pl. 2, fig. 3a-b; pl. 5, fig. 11). In the latter species, however, the posterior bar is not distally flattened and several denticles may be interposed between each enlarged one.

Genus *SPATHOGNATHODUS* Branson and Mehl, 1941

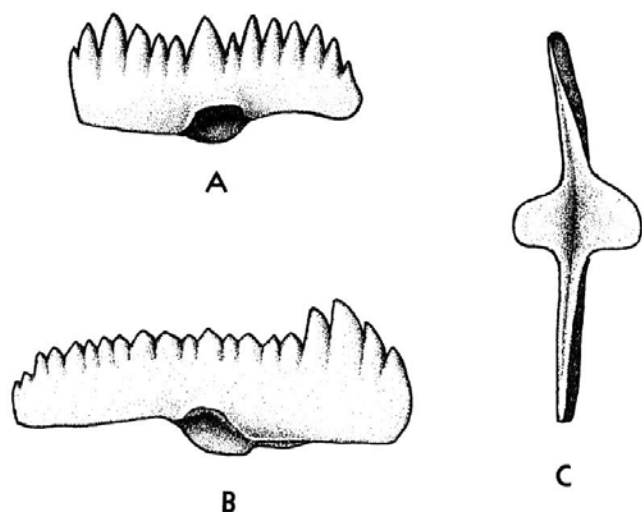
Spathognathodus exiguus Philip, new species Plate 3, figures 26-37; text-figure 7

Spathognathodus frankenwaldensis Bischoff and Sannemann. - PHILIP and PEDDER, 1964, p. 1324.

Name: Derived from the Latin *exiguus*, small.

Diagnosis: A species of *Spathognathodus* with strongly enlarged denticles at the anterior end. Basal cavity with markedly asymmetrical lobes, the outer lobe strongly projecting, while the inner lobe is usually not clearly delimited posteriorly from a tapering groove which extends to the posterior end of the unit.

Figured specimens: Holotype, 8850/13; 8850/12, 14-16; 8846/1; 8848/2.



TEXT-FIGURE 8

Spathognathodus steinhornensis buchanensis Philip, n. subsp. a, lateral view of Buchanan Caves Limestone form; b, c, lateral and aboral views of Murrindal Limestone form. $\times 50$.

Description: Unit slightly bowed in plan view; in lateral view posterior end bowed downwards. Oral margin usually with 12–16 denticles, the anterior 3–5 of which are enlarged, so that the anterior end of the unit is uniformly high. Above the basal cavity these enlarged denticles pass abruptly into small crowded denticles which in turn become progressively larger and more distant towards the sharply truncated posterior end.

Underside of unit excavated posteriorly by a posteriorly tapering groove; lobes of basal cavity asymmetrical, the outer one rounded and strongly projecting, delimited from the posterior groove by a marked re-entrant in the margin; inner lobe slightly projecting with its lateral margin curving evenly to the posterior end. Normally, the underside of the anterior end of the unit is marked by a seam, the inner side of which is projected strongly downwards in unbroken specimens (plate 3, figure 35).

Remarks: In the form of the lobes of the basal cavity this species does not appear to resemble described Devonian species of *Spathognathodus*. It approaches more closely such Carboniferous forms as *S. spiculus* Youngquist and Miller (Rexroad, 1957, pl. 3, figs. 18–21).

***Spathognathodus inclinatus inclinatus* (Rhodes)**

Plate 1, figures 30–31, 34–35, 37–39

Prioniodella inclinata RHODES, 1953, p. 324, pl. 23, figs. 233–235.
Spathognathodus inclinatus inclinatus (Rhodes). – WALLISER, 1964, pp. 76–77, pl. 8, fig. 6; pl. 19, figs. 6–21 (with synonymy).

Diagnosis: The typical barlike form of *Spathognathodus inclinatus* with regular flattened denticles which may be somewhat enlarged above the basal cavity or posteriorly. Basal cavity rather variable in position, lacking prominent lateral lobes.

Figured specimens: 8850/5–11.

Remarks: Walliser (1964, *loc. cit.*) has described the considerable variation seen in Silurian representatives of this species. He maintained that *S. wurmi* Bischoff and Sannemann should at most be regarded as a subspecies of *S. inclinatus*. After study of Australian Lower Devonian representatives of the species from Buchan and elsewhere, I am in full agreement with this interpretation. The Buchan specimens lack enlarged anterior denticles, and so most closely resemble Silurian representatives of *S. inclinatus inclinatus*.

Walliser has also suggested that *Ozarkodina simplex* Branson and Mehl (1933, p. 52, pl. 3, figs. 46–47) might well prove to be a senior synonym of *S. inclinatus*.

***Spathognathodus steinhornensis buchanensis* Philip,
new subspecies**

Plate 2, figures 1–28; text-figure 8

Diagnosis: A subspecies of *Spathognathodus steinhornensis* Ziegler (1956, pp. 104–105, pl. 7, figs. 3–10), in which the lateral lobes are centrally or somewhat anteriorly located.

Figured specimens: Holotype, 8845/9; 8844/1; 8845/10–15; 8849/16–17; 8850/17–20.

Description: Unit straight or slightly bowed in plan view; in lateral view the posterior end may be downwardly flexed. Oral margin with 10–24 denticles which may vary from relatively large, flattened and almost discrete to small, crowded and fused. One denticle above the basal cavity may be enlarged as may also denticles at the anterior end. Lobes of the basal cavity widely flaring and rounded, and tending to be centrally located. The basal cavity is continued posteriorly as an aboral groove; a similar anterior groove is not so well defined.

Remarks: Two forms of this subspecies are present in the Buchan fauna. The first (plate 2, figures 1–15; text-figure 8a) possesses comparatively few coarse separate denticles and is apparently confined to the Buchan Caves Limestone. The second (plate 2, figures 16–28; text-figure 8b–c), from the Murrindal Limestone, has more denticles, the anterior few of which are enlarged. These differences are so consistently developed that it was originally thought that two separate subspecies were represented. However, the separation cannot be upheld in spathognathodids in other Australian conodont faunas of the same age, so that it seems that both forms are variants of the one subspecies.

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The form from the Buchan Caves Limestone closely resembles *Spathognathodus steinhornensis eosteinhornensis* Walliser (1964, pl. 20, figs. 7–16, 19–25), but may be distinguished by the more central position of the lobes of the basal cavity. The relationship to *S. steinhornensis* is less obvious in the Murrindal Limestone form.

Spathognathodus sp. Plate 1, figure 36

Figured specimens: 8845/16.

Remarks: This is a deep massive species of *Spathognathodus* with large denticles and small lateral lobes to the basal cavity. More complete material is available from Devonian sequences in southern New South Wales, so that description of the species is deferred for the present.

Genus *Trichonodella* Branson and Mehl, 1948

Type species: *Trichognathus prima* Branson and Mehl, 1933.

Remarks: *Trichonodella* includes symmetrical or nearly symmetrical arched bars, usually with a prominent posteriorly produced lip above the enlarged basal cavity. In *Trichonodella symmetrica pinnula*, n. subsp. (described below), the basal cavity is but a tiny pit at the base of the cusp. The concept of the genus, therefore, must be modified to include this form.

Trichonodella excavata (Branson and Mehl) Plate 3, figure 22; plate 4, figures 22, 29

Trichognathus excavata BRANSON and MEHL, 1933, p. 51, pl. 3, figs. 35–36.

Trichonodella excavata (Branson and Mehl). – FAY, 1952, p. 198.

Trichonodella aboroflexa RHODES, 1953, pp. 312–313, pl. 23, figs. 231, 241–242.

Trichonodella symmetrica (Branson and Mehl). – RHODES, 1953, pp. 315–316, pl. 23, fig. 232 (not fig. 246).

Trichonodella cf. *excavata* sp. a WALLISER, 1957, p. 50, pl. 3, fig. 5.

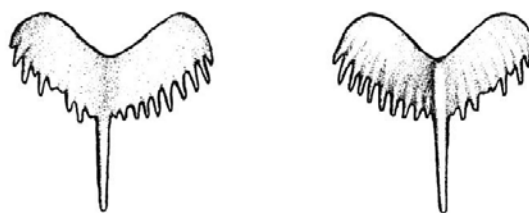
Trichonodella cf. *excavata* sp. b WALLISER, 1957, p. 50, pl. 3, fig. 9.

Trichonodella sp. GROSS, 1957, p. 81, text-fig. 1M.

Diagnosis: A species of *Trichonodella* with a thin anterior arch, the limbs of which diverge at an angle between 120° and 170°. Cusp large and triangular in cross section with a flattened anterior face. Limbs increasing in depth distally and usually somewhat recurved; denticles crowded and tending to increase in size distally. Basal cavity extends as a groove up the posterior face of the arch toward the base of the cusp and is outlined by a ridge, the apex of which is posteriorly projected.

Figured specimens: 8850/24–26.

Remarks: Ziegler (1960) has questioned Bischoff and Sannemann's (1958) identification of this species from the Lower Devonian of Frankenwald, as in their form the basal cavity is smaller and less strongly produced than in the typical form of the species. Ethington and Furnish (1962), however, found that the extent to



TEXT-FIGURE 9

Posterior and anterior aspects of *Trichonodella symmetrica pinnula* Philip, n. subsp., × 50.

which the lip of the basal cavity extends up the base of the cusp was a function of growth in the closely related *Plectospathodus extensus* Rhodes. The few specimens of *T. excavata* available from Buchan seem to show a similar trend, for the largest (plate 3, figure 22) has the largest and most strongly produced basal cavity. It is therefore doubtful whether much taxonomic significance should be placed on this feature, although it may eventually prove desirable to separate the Lower Devonian form of this species as a new subspecies.

Trichonodella inconstans Walliser Plate 3, figure 23; plate 4, figures 21, 23, 27, 30

Trichonodella inconstans WALLISER, 1957, pp. 50–51, pl. 3, figs. 10–17.

Trichonodella cf. *inconstans* Walliser. – JENTZSCH, 1963, p. 947, pl. 3, figs. 5, 7.

Diagnosis: A species of *Trichonodella* with a thick anterior arch, the limbs of which diverge at an angle between about 60° and 120°. Cusp rounded in cross section and curved posteriorly. Denticles of limbs separate and rounded in cross section. Underside of unit excavated, and deepened under the cusp to form the basal cavity, which has a small posterior lip.

Figured specimens: 8844/2; 8845/17–19; 8850/27.

Trichonodella sp. cf. *T. inconstans* Walliser Plate 4, figures 24–25

Figured specimens: 8843/1; 8850/22.

Remarks: Two large broken specimens of *Trichonodella* appear to differ from *T. excavata* in the following respects:

- 1) The unit is very thick at the base of the cusp, and the posterior projection above the basal cavity is somewhat downwardly projected.
- 2) There are only a few, large, well-spaced denticles on the lateral limbs.

Whether these are large variants of *T. inconstans* or represent a different species cannot be decided from the available material.

Trichonodella symmetrica pinnula Philip, new subspecies
Plate 4, figures 1-6; text-figure 9

Name: Derived from the Latin *pinnula*, a small feather.

Diagnosis: A form of *Trichonodella symmetrica* (Branson and Mehl) (= *Trichognathus symmetrica* Branson and Mehl, 1933, p. 50, pl. 3, figs. 33-34) with a tiny basal cavity and thin, deep, recurved lateral limbs with small regular denticles. Cusp laterally flattened, long and slender.

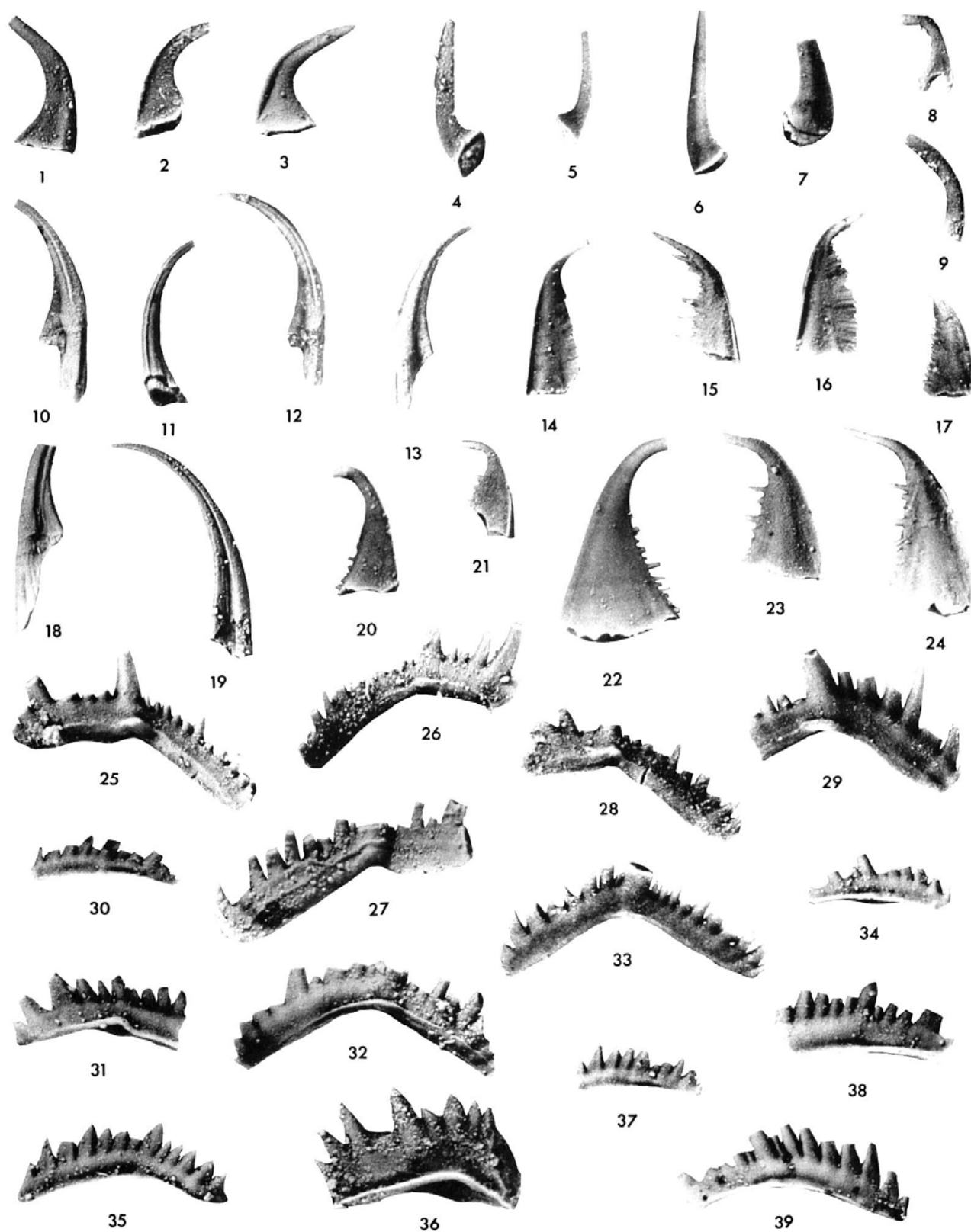
Figured specimens: Holotype, 8845/20; 8845/21-22.

Description: Lateral bars thin and deep, with rounded extremities and diverging at an angle of between 90° and 120°. In oral view, the limbs are flexed posteriorly to the cusp. Denticles small, regular, flattened in cross section, occasionally with smaller denticles interposed; usually between 8 and 10 to each limb, becoming progressively reclined distally. Cusp strongly flattened laterally and curved posteriorly; in anterior view, slen-

PLATE 1

All figures × 35

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|--|--|
| <p>1-3 <i>Panderodus valgus</i> (Philip)
1, lateral view of 8847/22, locality 6.
2, lateral view of 8847/23, locality 6.
3, lateral view of 8849/6, locality 8.</p> <p>4-5 <i>Drepanodus</i> sp. A
4, lateral view of 8847/19, locality 6.
5, lateral view of 8847/20, locality 6.</p> <p>6-7 <i>Drepanodus</i> sp. B
6, lateral view of 8847/17, locality 6.
7, lateral view of 8847/18, locality 6.</p> <p>8-9 <i>Panderodus</i> sp. cf. <i>P. recurvatus</i> (Rhodes)
8, lateral view of 8847/13, locality 6.
9, lateral view of 8847/14, locality 6.</p> <p>10-12, <i>Panderodus uncostatus</i> (Branson and Mehl)
10, lateral view of 8847/26, locality 6.
11, lateral view of 8847/25, locality 6.
12, lateral view of 8847/24, locality 6.
19, lateral view of 8847/27, locality 6.</p> <p>13, 18 <i>Panderodus acostatus</i> (Branson and Branson)
13, lateral view of 8847/29, locality 6.
18, lateral view of 8847/28, locality 6.</p> <p>14-17 <i>Belodella resima</i> (Philip)
14, lateral view of 8847/21, locality 6.
15, lateral view of 8849/5, locality 8.
16, lateral view of 8849/4, locality 8.
17, lateral view of 8849/15, locality 8.</p> | <p>20-21 <i>Belodella triangularis</i> (Stauffer)
20, lateral view of 8847/15, locality 6.
21, lateral view of 8849/7, locality 8.</p> <p>22-24 <i>Belodella</i> sp. cf. <i>B. devonica</i> (Stauffer)
22, lateral view of 8847/16, locality 6.
23, lateral view of 8849/13, locality 8.
24, lateral view of 8849/14, locality 8.</p> <p>25-28 <i>Plectospathodus extensus lacertosus</i> Philip, n. subsp.
25, inner view of 8850/2, locality 6.
26, inner view of holotype, 8850/3, locality 6.
27, inner view of 8850/1, locality 6.
28, inner view of 8848/1, locality 7.</p> <p>29, <i>Ozarkodina media</i> Walliser</p> <p>32-33 29, inner view of specimen with enlarged anterior denticles, 8847/3, locality 7.
32, inner view of 8847/2, locality 7.
33, inner view of 8847/1, locality 7.</p> <p>30-31, <i>Spathognathodus inclinatus inclinatus</i> (Rhodes)
34-35, 30, lateral view of 8850/11, locality 6.
37-39 31, lateral view of 8850/8, locality 6.
34, lateral view of 8850/9, locality 6.
35, lateral view of 8850/5, locality 6.
37, lateral view of 8850/10, locality 6.
38, lateral view of 8850/6, locality 6.
39, lateral view of 8850/7, locality 6.</p> <p>36 <i>Spathognathodus</i> sp.
Lateral view of 8845/16, locality 3.</p> |
|--|--|



der and gently tapered; base projecting posteriorly from the lateral bars. Basal cavity is a small triangular pit at the base of the cusp.

Remarks: This subspecies differs from typical specimens of *Trichonodella symmetrica* in its very tiny basal cavity and the flattened cusp. It thus appears to resemble more closely the Carboniferous genus *Hindeodus* Rexroad and Furnish, 1964, than typical species of *Trichonodella*. *T. symmetrica pinnula* differs from *Trichonodella imperfecta* Rexroad (1957, p. 41, pl. 4, figs. 4-5), the type species of *Hindeodus*, solely in the flattened nature of the cusp and the recurved lateral limbs. The Buchan form is described as a subspecies of *T. symmetrica*, for it is probably derived from that species.

Trichonodella sp.
Plate 4, figure 26

Figured specimen: 8850/23.

Remarks: This small form resembles the Silurian species *Trichonodella symmetrica* (Branson and Mehl, 1933, p. 50, pl. 3, figs. 33-34) in possessing enlarged denticles toward the distal extremities of the lateral limbs. The anterior face of the slender cusp is flattened, and the basal cavity is a pit with a low posterior lip beneath the cusp.

Genus and species not determined
Plate 3, figure 3

Figured specimen: 8849/8.

Remarks: This is a somewhat bowed bar with large, regular denticles. Although generic relationships of this form are obscure, as it is a distinctive fragment, it is illustrated for completeness. Stauffer (1938, pl. 52, figs. 1, 4, 6) has figured similar fragments from the Olentangy Shale as *Ligonodina?* sp.

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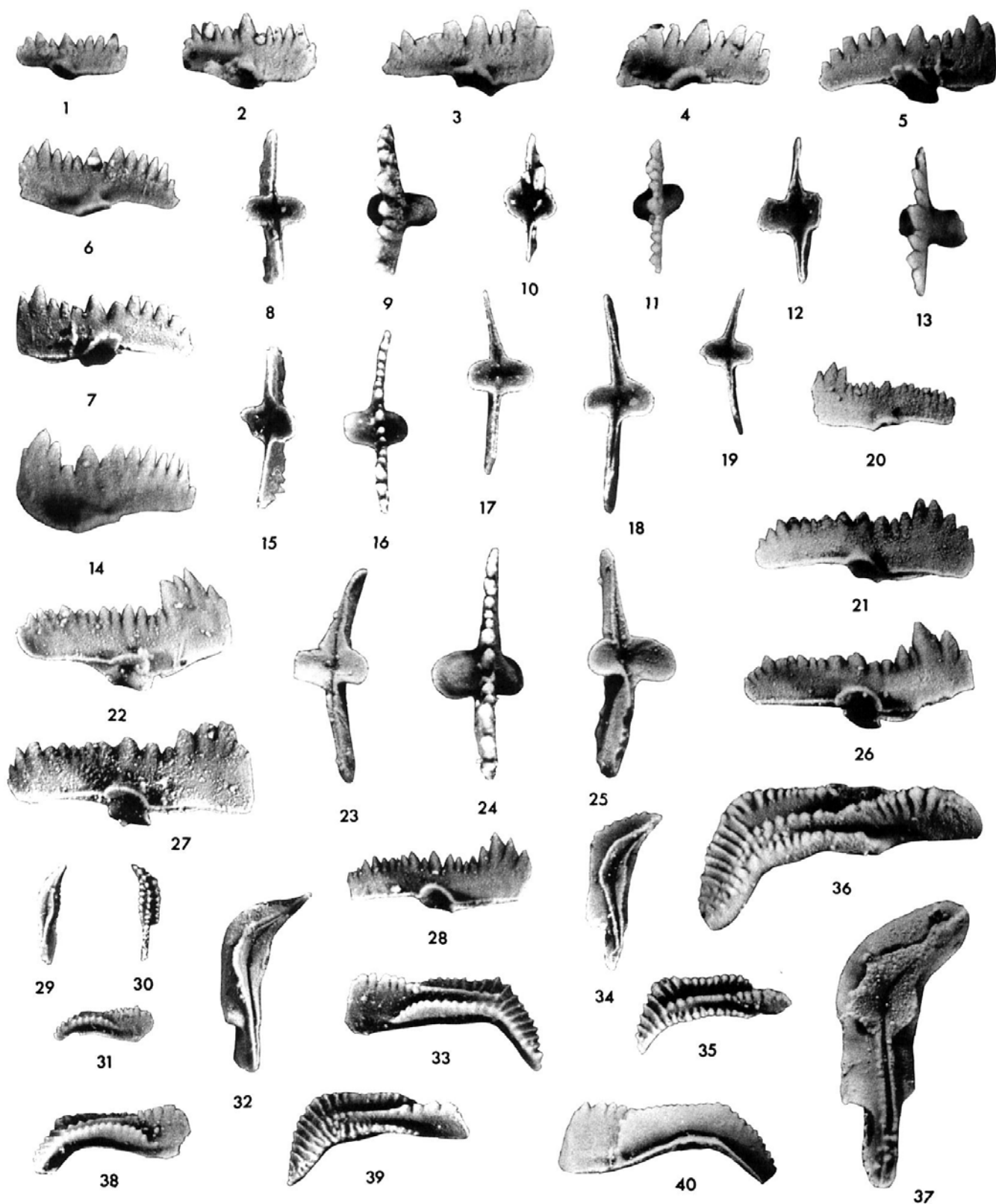
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PLATE 2

All figures $\times 35$

- 1-28 *Spathognathodus steinhornensis buchaniensis* Philip, n. subsp.
1, lateral view of 8845/14, locality 3.
2, lateral view of 8845/10, locality 3.
3, lateral view of 8845/11, locality 3.
4, lateral view of 8845/12, locality 3.
5, lateral view of 8844/1, locality 2.
6, lateral view of holotype, 8845/9, locality 3.
7, lateral view of 8844/1, locality 2.
8, aboral view of 8845/12, locality 3.
9, oral view of 8845/12, locality 3.
10, aboral view of 8845/10, locality 3.
11, oral view of 8845/10, locality 3.
12, aboral view of 8845/11, locality 3.
13, oral view of 8845/11, locality 3.
14, lateral view of 8845/13, locality 3.
15, aboral view of holotype, 8845/9, locality 3.
16, oral view of 8850/17, locality 6.
17, aboral view of 8850/17, locality 6.
18, aboral view of 8849/17, locality 8.
19, aboral view of 8849/16, locality 8.
20, lateral view of 8849/16, locality 8.

- 21, lateral view of 8849/17, locality 8.
22, lateral view of 8850/19, locality 6.
23, aboral view of 8850/19, locality 6.
24, oral view of 8850/18, locality 6.
25, aboral view of 8850/18, locality 6.
26, lateral view of 8850/18, locality 6.
27, lateral view of 8850/20, locality 6.
28, lateral view of 8850/17, locality 6.
- 29-40 *Polygnathus linguiformis* Hinde
29, aboral view of 8847/4, locality 6.
30, oral view of 8847/4, locality 6.
31, lateral view of 8847/4, locality 6.
32, aboral view of 8847/6, locality 6.
33, lateral view of 8847/6, locality 6.
34, aboral view of 8847/5, locality 6.
35, oblique lateral views of 8847/5, locality 6.
36, oblique lateral view of 8847/7, locality 6.
37, aboral view of 8847/7, locality 6.
38, lateral view of 8846/2, locality 5.
39, oblique lateral view of 8849/11, locality 8.
40, lateral view of 8847/8, locality 6.

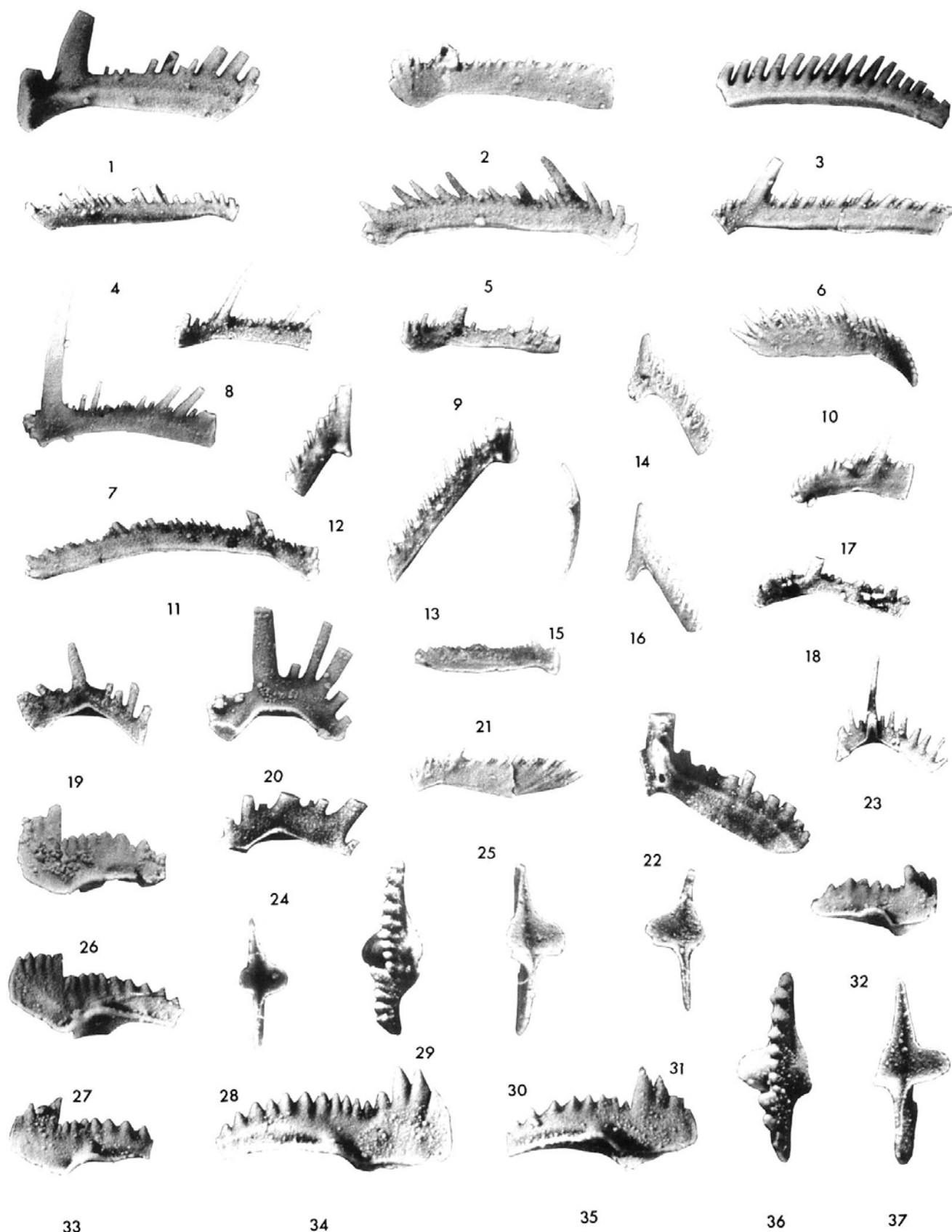


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PLATE 3

All figures $\times 35$

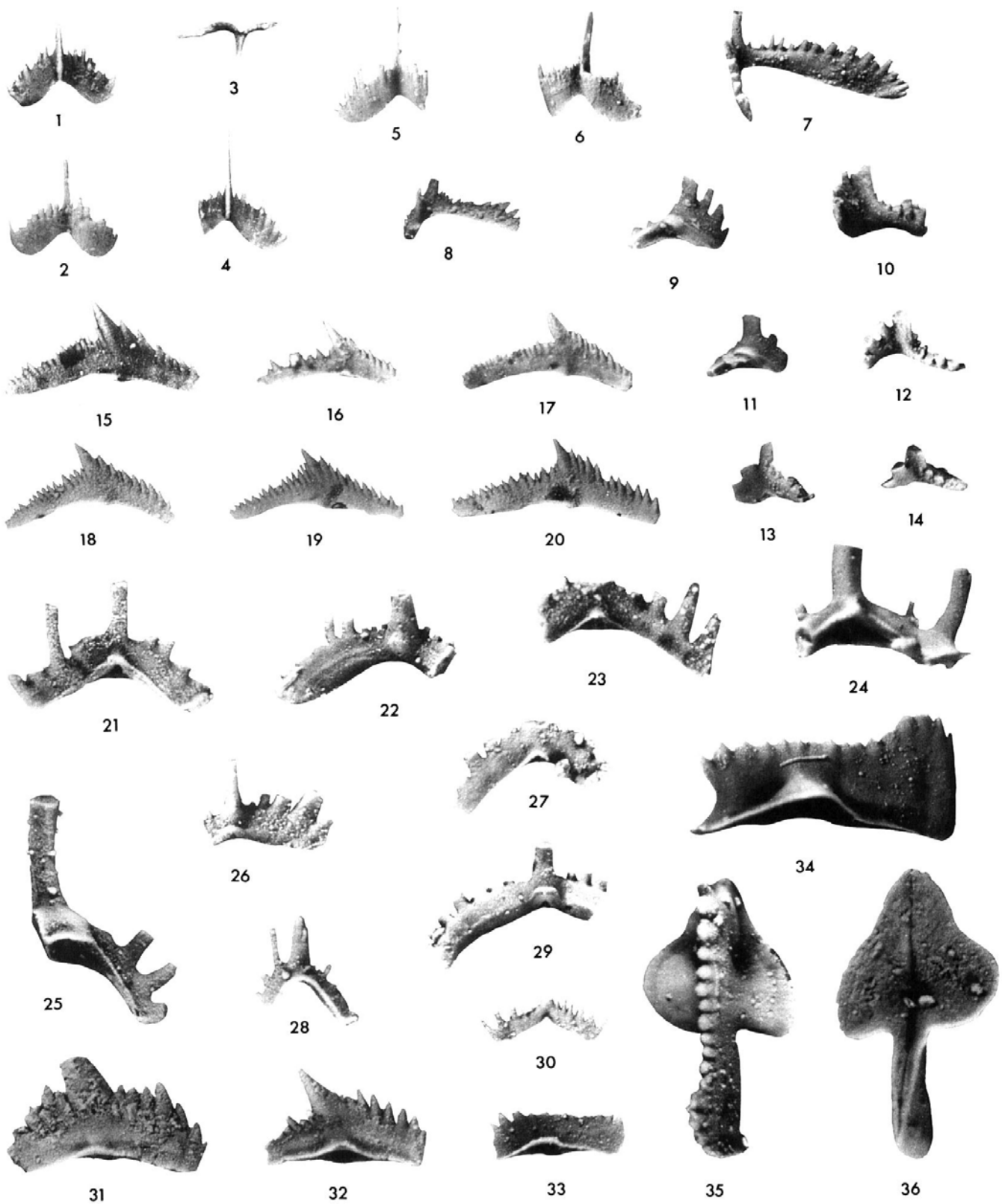
- | | | |
|-------------------|---|---|
| 1 | <i>Hindeodella equidentata</i> Rhodes
Lateral view of 8850/28, locality 6. | 14, outer view of 8845/31, locality 3.
15, oblique aboral view of 8845/32, locality 3.
16, outer view of 8845/30, locality 3. |
| 2, 6-9,
11, 18 | <i>Hindeodella priscilla</i> Stauffer
2, lateral view of 8845/23, locality 3.
6, lateral view of 8847/12, locality 6.
7, lateral view of 8845/1, locality 3.
8, lateral view of 8847/10, locality 6.
9, lateral view of 8844/3, locality 2.
11, lateral view of 8847/9, locality 6.
18, lateral view of 8847/11, locality 6. | 19-20, <i>Lonchodina</i> n. sp.
24 19, lateral view of 8845/28, locality 3.
20, lateral view of 8845/27, locality 3.
24, lateral view of 8850/29, locality 6. |
| 3 | Genus and sp. not determined
Lateral view of 8849/8, locality 8. | 22 <i>Trichonodella excavata</i> (Branson and Mehl)
Posterior view of 8850/25, locality 6. |
| 4 | <i>Hindeodella</i> sp. A
Lateral view of 8847/13, locality 6. | 23 <i>Trichonodella inconstans</i> Walliser
Posterior view of 8844/2, locality 2. |
| 5 | <i>Hindeodella</i> sp. B
Lateral view of 8849/10, locality 8. | 26-37 <i>Spathognathodus exiguus</i> Philip, n. sp.
26, lateral view of 8848/2, locality 5.
27, lateral view of 8850/14, locality 6.
28, aboral view of 8850/16, locality 6.
29, oral view of 8850/14, locality 6.
30, aboral view of 8850/14, locality 6.
31, aboral view of 8850/15, locality 6.
32, lateral view of 8846/1, locality 7.
33, lateral view of 8850/15, locality 6.
34, lateral view of 8850/12, locality 6.
35, lateral view of holotype, 8850/13, locality 6.
36, oral view of holotype, 8850/13, locality 6.
37, aboral view of holotype, 8850/13, locality 6. |
| 10, 17,
21, 25 | <i>Plectospathodus alternatus</i> Walliser
10, lateral view of 8845/2, locality 3.
17, lateral view of 8845/24, locality 3.
21, lateral view of 8845/25, locality 3.
25, lateral view of 8845/26, locality 3. | |
| 12-16 | <i>Neoprioniodus bicurvatus</i> (Branson and Mehl)
12, inner view of 8850/30, locality 6.
13, inner view of 8850/31, locality 6. | |



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PLATE 4

- 1-6 *Trichonodella symmetrica pinnula* Philip, n. subsp.
1, posterior view of holotype, 8845/20, locality 3.
2, anterior view of holotype, 8845/20, locality 3.
3, oral view of 8845/21, locality 3.
4, posterior view of 8845/21, locality 3.
5, anterior view of 8845/21, locality 3.
6, oblique anterior view of 8845/22, locality 3.
- 7-8 *Roundya perbona* Philip, n. sp.
7, lateral view of holotype, 8850/21, locality 6.
8, lateral view of 8846/3, locality 5.
- 9-14 *Lonchodina murrindalensis* Philip, n. sp.
9, aboral-lateral view of holotype, 8850/32, locality 6.
10, lateral view of holotype, 8850/32, locality 6.
11, aboral-lateral view of 8850/33, locality 6.
12, oral view of holotype, 8850/32, locality 6.
13, lateral view of 8850/33, locality 6.
14, oral view of 8850/33, locality 6.
- 15-20 *Ozarkodina denckmanni* Ziegler
15, lateral view of 8850/4, locality 6.
16, lateral view of 8845/3, locality 3.
17, lateral view of 8845/4, locality 3.
18, lateral view of 8849/1, locality 8.
19, lateral view of 8849/3, locality 8.
20, lateral view of 8849/2, locality 8.
- 21, 23, *Trichonodella inconstans* Walliser
27, 30 21, posterior view of 8847/17, locality 3.
23, posterior view of 8850/27, locality 6.
27, posterior view of 8845/18, locality 3.
30, posterior view of 8845/19, locality 3.
- 22, 29 *Trichonodella excavata* (Branson and Mehl)
22, posterior view of 8850/24, locality 6.
29, posterior view of 8850/26, locality 6.
- 24-25 *Trichonodella* sp. cf. *T. inconstans* Walliser
24, posterior-aboral view of 8843/1, locality 1.
25, posterior view of 8850/26, locality 6.
- 26 *Trichonodella* sp.
Posterior view of 8850/23, locality 6.
- 28 *Ozarkodina?* sp.
Lateral view of 8845/29, locality 3.
- 31-32 *Ozarkodina* sp. cf. *O. jaegeri* Walliser
31, lateral view of 8845/6, locality 3.
32, lateral view of 8845/5, locality 3.
- 33-36 *Eognathodus linearis* Philip, n. sp.
33, lateral view of 8845/8, locality 3.
34, lateral view of holotype, 8845/7, locality 3.
35, oral view of holotype, 8845/7, locality 3.
36, aboral view of holotype, 8845/7, locality 3.



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