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BUREAU OF MINERAL RESOURCES, GEOLOGY
AND GEOPHYSICS

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**Conodonts from the Fairfield
Group, Canning Basin,
Western Australia**

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SUMMARY

Conodonts from the Fairfield Group, Canning Basin were examined in order to determine both the sequence of species and the age of the Group. This work is part of a larger study of the latest Devonian and Early Carboniferous rocks exposed on the northern margin of the basin. A total of 57 form species referable to 21 form genera and an additional two multi-element taxa are described: two multi-element species, *Icriodus platys* and *Pelekysgnathus australis*, and one form species, *Spathognathodus canningensis*, are new and one form species, *Hibbardella helmsi*, has a new name. One multi-element taxon and fourteen form species are left in open nomenclature.

Six assemblage zones are recognised although the endemic nature of the fauna and differing ranges of form species from those recorded elsewhere preclude accurate correlation with other sequences in Australia and overseas. However, a broad correlation is presented. The two lowest assemblage zones are latest Devonian and are present in the Gumhole Formation and the lowermost part of the Yellow Drum Sandstone. The upper four assemblage zones are Early Carboniferous (Tournaisian) and are present in the remainder of the Yellow Drum Sandstone and the Laurel Formation.

INTRODUCTION

The Canning Basin is located along the southwestern margin of the Kimberley Block in Western Australia and is the largest Phanerozoic sedimentary basin (450 000 km²) in the state. Palaeozoic sediments of Ordovician to Permian age are present.

From May to August 1972 a joint field party of BMR and the Geological Survey of Western Australia examined the Upper Devonian-Lower Carboniferous sequence along 275 km of the northern margin of the Canning Basin centred near Fitzroy Crossing. Detailed field work was concentrated in three areas (Fig. 1): (1) a narrow belt about 10 km wide extending along the southwestern margins of the Oscar and Napier Ranges; (2) the Horseshoe and Burramundi Ranges, 65 km east of Fitzroy Crossing; and (3) the Red Bluffs area, 135 km southeast of Fitzroy Crossing.

The area studied is traversed by the Great Northern Highway and the Derby-Mount House road. Outcrops are generally accessible by station tracks, but a four-wheel-drive vehicle is necessary in some areas. In the Horseshoe Range access is difficult, and most of the material from that area was collected during a helicopter traverse.

PURPOSE OF INVESTIGATION

The Upper Devonian-Lower Carboniferous platform sediments of the Fairfield Group consist of a sequence of interbedded limestone, shale, and sandstone that postdates a Devonian reef complex (Playford & Lowry, 1966). Exposures of the platform sediments are generally poor and as a consequence the Fairfield Group has received much less geological attention than the adjacent, well exposed, presumed reef complex.

Previous work on the Fairfield Group by a number of authors including Teichert (1949), Guppy et al. (1958), G. A. Thomas (1957; 1959), Veevers & Wells (1961), Playford & Lowry (1966), Roberts et al. (1972) and Jones et al. (1973), has led to a number of differing interpretations of the post-reef, pre-Permian sediments (see Fig. 8). Our study was undertaken in an attempt to resolve these differences.

METHOD OF STUDY

A multidisciplinary approach to the problem was undertaken; where possible, samples for palaeontological, petrological, and geochemical analysis were col-

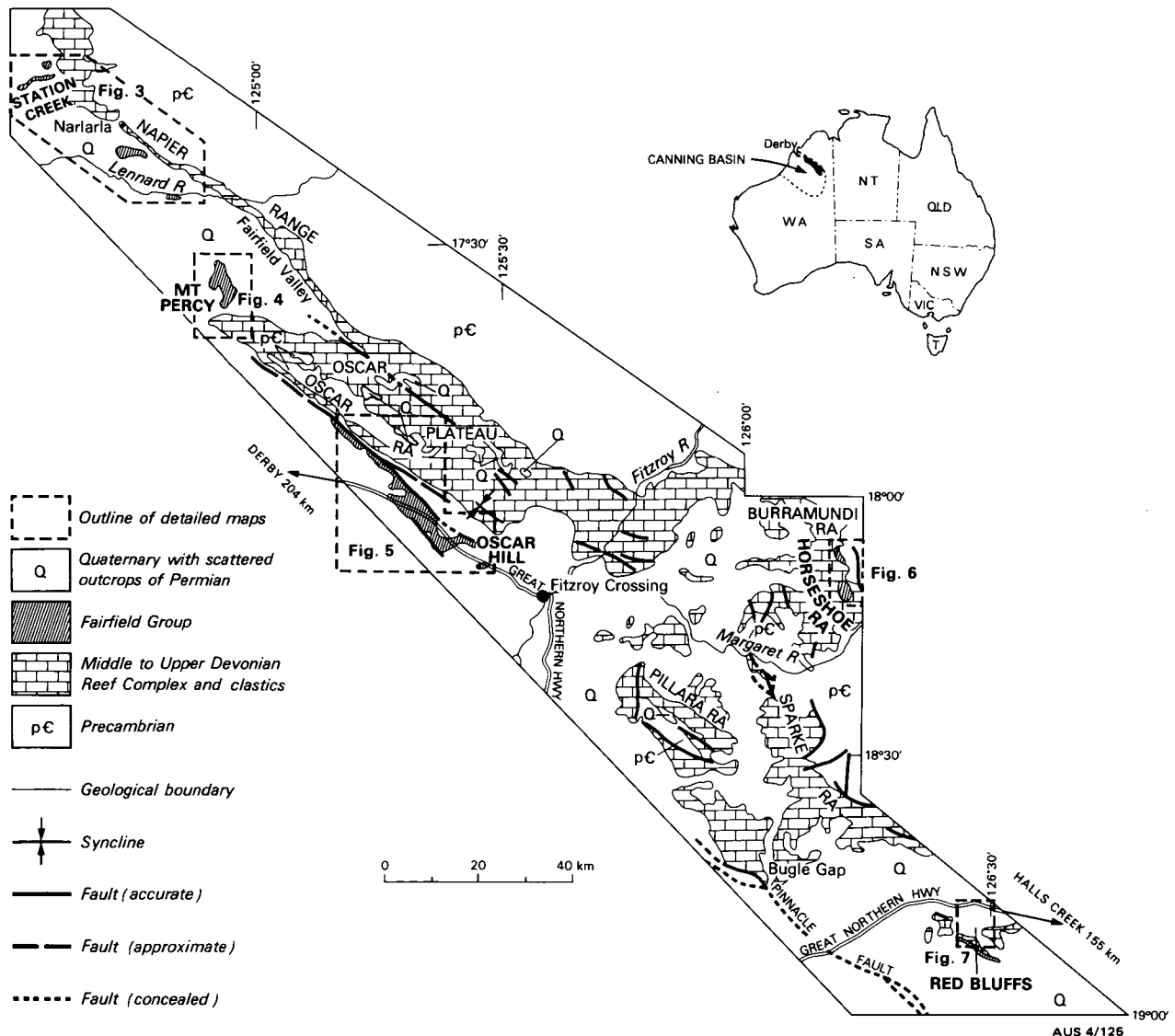


Fig. 1. Locality map, Fairfield Group exposures.

lected from each sample interval. Results of the cluster analysis of petrological and geochemical studies have been published separately (Radke, 1976; Druce & Radke, 1977). A general study of the Devonian-Carboniferous of the Fairfield Group by Druce & Radke (1979) is in press.

In all, 580 samples were collected from 39 localities (Figs. 3-7 and appendixes) including three shallow, continuously cored stratigraphic drillholes, BMR Lennard River No. 1, BMR Lennard River No. 2, and BMR Noonkanbah No. 4 (Druce & Radke, 1973). Where possible, stratigraphic sections were measured and channel samples were collected to represent successive 1.5-m intervals (see Appendix C).

ACKNOWLEDGEMENTS

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GENERAL GEOLOGY

PREVIOUS INVESTIGATIONS

Stratigraphic interpretations of the Fairfield Group sequence arising from investigations by Teichert (1949), Thomas (1957; 1958), Guppy, Lindner, Rattigan & Casey (1958), Veevers & Wells (1961), Playford & Lowry (1966), Roberts et al. (1972), Jones et al. (1973), and Druce & Radke (1979) are presented in Figure 8. Detailed discussion of the history of investigations and the geological interpretations of the Fairfield Group are given in Druce & Radke (1979), from which the following stratigraphy is condensed.

STRATIGRAPHY

The Fairfield Group is divided into three formations (see Fig. 2): the Gumhole Formation, the Yellow Drum Sandstone, and the Laurel Formation. The Yellow Drum Sandstone straddles the Devonian/Carboniferous boundary.

Gumhole Formation

The Gumhole Formation consists of about 70 m of limestone, siltstone, and shale with minor dolomite and sandstone. It overlies an unnamed 'birdseye limestone' (a probable algal flat carbonate) in the Horseshoe Range (Fig. 6) and the Red Bluffs area (Fig. 7) and a greenish grey shale and mottled greenish red siltstone

(probably equivalent to the basinal Luluigui Formation) in the area southwest of the Oscar and Napier Ranges. In the subsurface the Gumhole thickens southward to a maximum recorded thickness of 369 m in Meda No. 1 well (17°24'00"S, 124°11'50"E), 56 km east of Derby.

Yellow Drum Sandstone

The Yellow Drum Sandstone consists of about 70 m of friable sandstone and dolomite with minor shale, siltstone, and rare thin limestone beds. The unit conformably overlies, and intertongues with, the Gumhole Formation.

In the subsurface the Yellow Drum Sandstone extends across the Fitzroy Trough and is penetrated in several wells, which provide considerable information to augment the scanty information obtained from the rare and poor outcrops. In the subsurface a thickness of over 300 m is recorded from the Napier No. 1 well (17°12'20"S, 124°31'36"E), 100 km east-northeast of Derby.

Laurel Formation

The Laurel Formation consists of a lower limestone member about 80 m thick, a middle silty shale member about 180 m thick, and an upper limestone member about 125 m thick. These thicknesses were measured in the type area where Thomas (1959) estimated the poorly exposed sequence to be 455 m thick and which we measured as 385 m. The lower limestone member consists of white, yellow, and brown bioclastic and intraclastic limestone with interbedded shale and siltstone. The middle member is dominantly grey calcareous shale and siltstone with minor pale brown limestone and pale grey sandstone. The upper limestone member contains minor sandy limestone and shale. The unit extends across the Fitzroy Trough in the subsurface, and considerable thicknesses of the upper members are preserved: 648 m in Lake Betty No. 1 (19°34'08"S, 126°19'45"E) and 259 m in Yulleroo No. 1 (17°51'16"S, 122°54'24"E).

On the Lennard Shelf the Laurel Formation intertongues with the Yellow Drum Sandstone and is usually unconformably overlain by the Permian Grant Formation, whereas in the Fitzroy Trough the clastic Anderson Formation conformably succeeds the silty shale member.

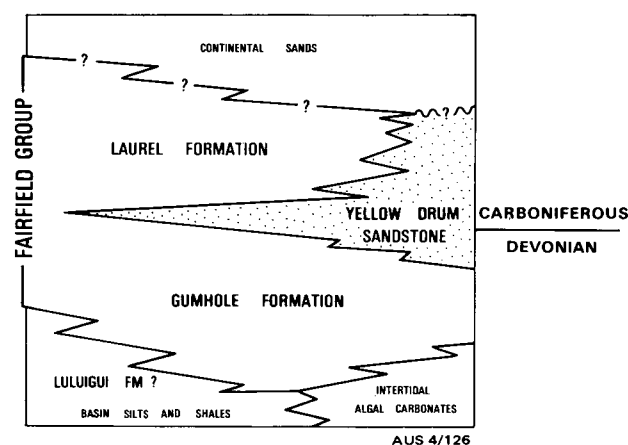


Fig. 2. Time-stratigraphic interpretations of the uppermost Devonian and lowermost Carboniferous rocks exposed on the northern margin of the Canning Basin.

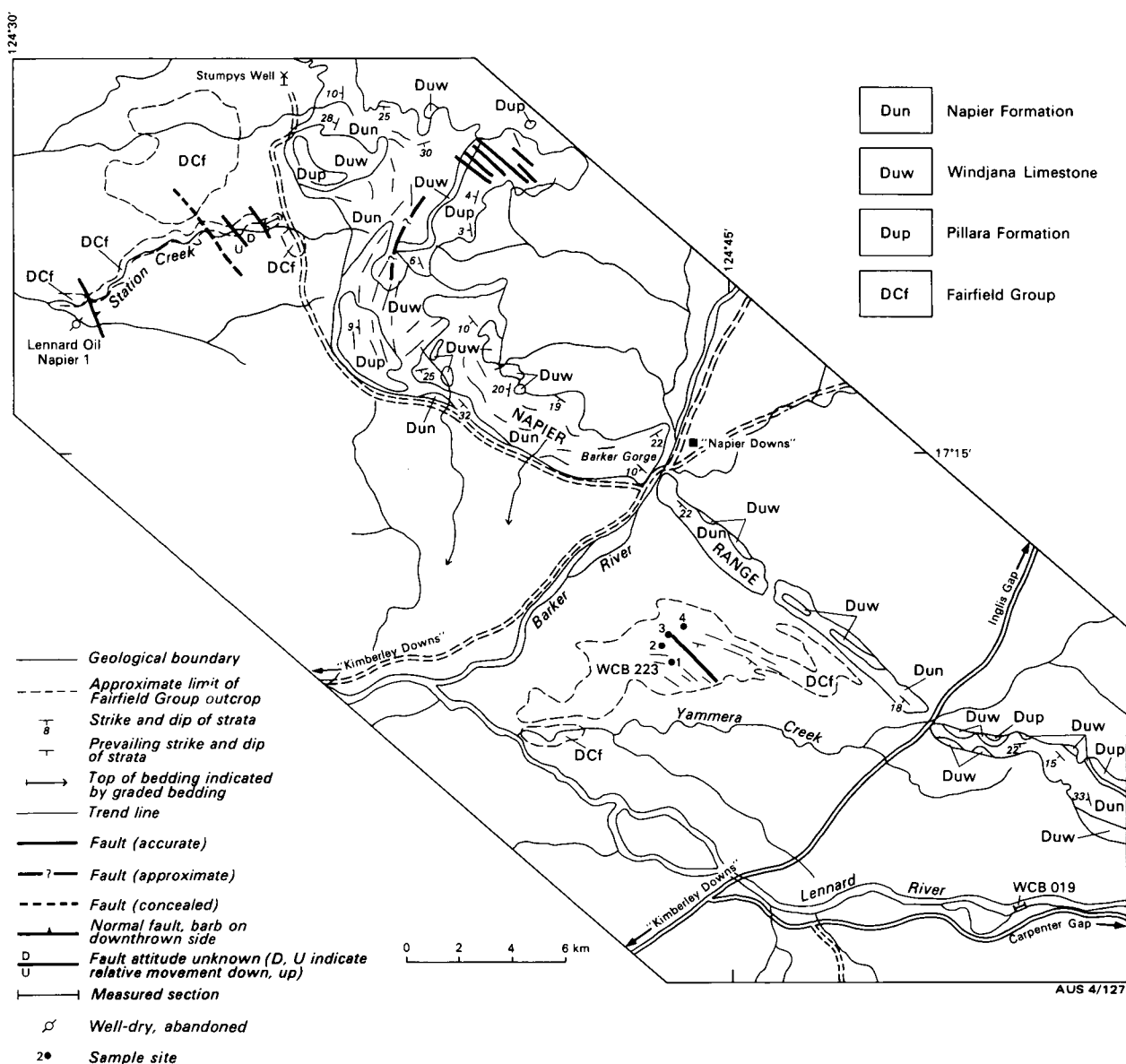


Fig. 3. Geology of the Fairfield Group, Station Creek to Lennard River.

PREVIOUS CONODONT STUDIES

AUSTRALIA

Previous investigations of Famennian and Tournaisian conodont faunas have been reviewed by Druce (1974). Major information is available from the Bonaparte Gulf Basin (Druce, 1969) and Canning Basin (Glenister & Klapper, 1966; Druce, 1976) and sparse information from scattered localities in eastern Australia has been published by Druce (1970), Philip & Jackson (1971), and Jenkins (1974). Apart from the last paper and Druce (1976), all these data have been summarised in Roberts et al. (1972) and Jones et al. (1973).

CANNING BASIN

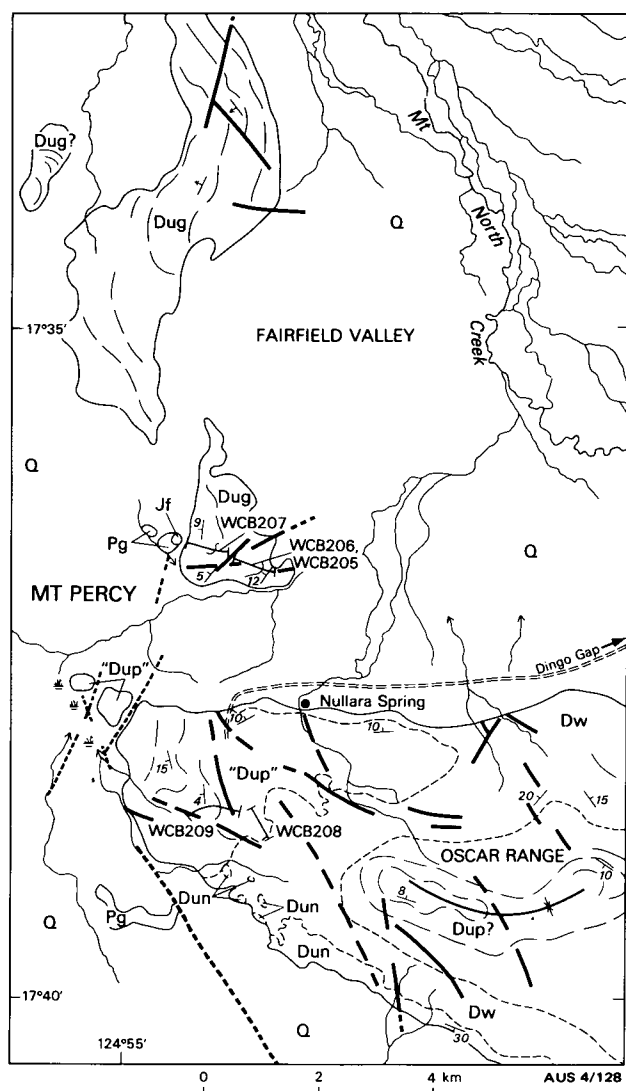
Conodonts from the Canning Basin were mentioned first by Guppy & Öpik (1950) who included them in a table listing the Ordovician fauna.

Devonian forms were first reported by Glenister (1958) and McWhae et al. (1958), although, in 1956,

Müller had illustrated a specimen from the Canning Basin in a general paper on the taxonomy, nomenclature, orientation, and stratigraphic evaluation of conodonts. Carboniferous conodonts were first identified by Glenister, who listed and discussed the conodonts and an ammonoid from the Laurel Beds in a paper presented to the 4th Carboniferous Congress in 1958 but not published until 1960. Thomas (1959) was the first to report in print the presence of Carboniferous conodonts when he cited the identifications made by Glenister.

Devonian

Late Devonian conodonts from the pre-Fairfield reef complex of the Canning Basin have received considerable attention because of their relative abundance, their similarity to forms from Europe and North America, and because the European zonation can be recognised. The similarity at the generic level was noted by



Q	Superficial deposits	—	Geological boundary (accurate)
Jf	Fitzroy Lamproite	- - -	Geological boundary (approximate)
Pg	Grant Formation	$\frac{1}{4}$	Strike and dip of strata
Dug	Gumhole Formation	∇	Dip < 15° - airphoto interpretation
"Dup"	? Pillara Limestone (algal flat carbonates)	—	Trend line
Dup	Pillara Limestone	$\star$	Syncline
Dun	Napier Limestone	—	Fault (accurate)
Dw	Windjana Limestone	- - -	Fault (approximate)
		- - -	Fault (concealed)
		—	Measured section

Fig. 4. Geology of the Fairfield Group, Mount Percy area.

Glenister & Crespin (1959) and Glenister (1960). These faunas were later described in detail by Glenister & Klapper (1966) who demonstrated their specific similarity and zonal application. More recently Druce (1976) has described in detail faunas from measured sections throughout the different facies of the Frasnian and Famennian reef complexes. Philip & McDonald (1975) have described polygnathid apparatuses from the Gogo and Virgin Hills Formations.

Much less information has been published on conodonts from the Gumhole Formation. The first record of

specimens from this unit was in Glenister & Klapper (1966) although Glenister (1962) listed conodonts from an interval in Frome Rocks No. 2 Well, located on the southern margin of the Fitzroy Trough, which is now recognised as probably equivalent to the Gumhole Formation. Glenister & Klapper (1966) mentioned conodonts from six samples collected from the Fairfield Formation and one from equivalent strata. The Fairfield Formation *sensu* Glenister & Klapper extends from the Late Devonian into the Early Carboniferous and approximates to the Fairfield Group (Druce & Radke, 1979). Of the Glenister & Klapper samples, three are from the Gumhole Formation and three from the Laurel Formation (see below); the seventh sample (GI/B30) is from strata which they tentatively placed in the Bugle Gap Limestone (Druce, 1976) but which should be placed in the Piker Hills Formation.

The three Gumhole samples are WAPET A (a 20 m section which yielded a single specimen); Meda No. 1 Well, core 11 (1883-1886 m); and GSWA 1053. The WAPET A section is at Oscar Hill (Fig. 5) and is equivalent to our section WCB 002; however, although our samples yielded usable faunas, the WAPET section was barren except for a single simple cone. Sample GSWA 1053 yielded a single specimen identified as *Pelekysgnathus communis* Thomas by Glenister & Klapper but not illustrated; it is probably referable to *Pelekysgnathus australis* (sp. nov. herein). The fauna from core 11 of Meda No. 1 Well contains a single specimen of *P. communis* in addition to four specimens of *Polygnathus* cf. *P. obliquicostatus* Ziegler, which Druce (1976) considers to be more probably *Polygnathus znepolensis* Spasov.

In addition to the above three samples, one sample K289 described by Glenister & Klapper as probable Pillara Limestone, was collected from a sequence in which the type section of the Fairfield Beds (DF 2 of Guppy et al., 1958) was designated. We consider the Fairfield Beds at this locality (Horseshoe Range) to be Gumhole Formation, conformably overlying an unnamed algal flat carbonate unit herein called the 'birds-eye limestone' which has previously been referred to the mainly Frasnian Pillara Limestone. Sample K289 was within this unit and is of late Famennian age.

Bischoff (*vide* Roberts et al., 1972) reports *Spathognathodus spinulicostatus* (E. R. Branson), *S. ziegleri* Rhodes et al., and *Palmatolepis gracilis sigmoidalis* from the Gumhole Formation equivalent in Yulleroo No. 1 Well (Gewerkschaft Elwerath, 1967). The only other records of conodonts from the Gumhole Formation are in the unpublished well completion report for Palm Spring No. 1 (WAPET, 1972).

No conodonts have been previously reported from the Yellow Drum Sandstone, which straddles the Devonian/Carboniferous boundary.

Carboniferous

Since the recording of conodonts from the Laurel Formation by Thomas (1959) and Glenister (1960) little information has been published. Glenister & Furnish (1962) recorded specimens from Meda No. 1 Well, and Druce (*in* Roberts & Veevers, 1967) reported specimens in the upper part of the exposed Laurel Formation which are similar to forms in the Enga Sandstone of the Bonaparte Gulf Basin; Jones (*in* Roberts et al., 1972) identified and listed these specimens.

Three of the Glenister & Klapper (1966, tables 4 & 9) samples, DF 10-3, DF 10-5, and GSWA 3240, were

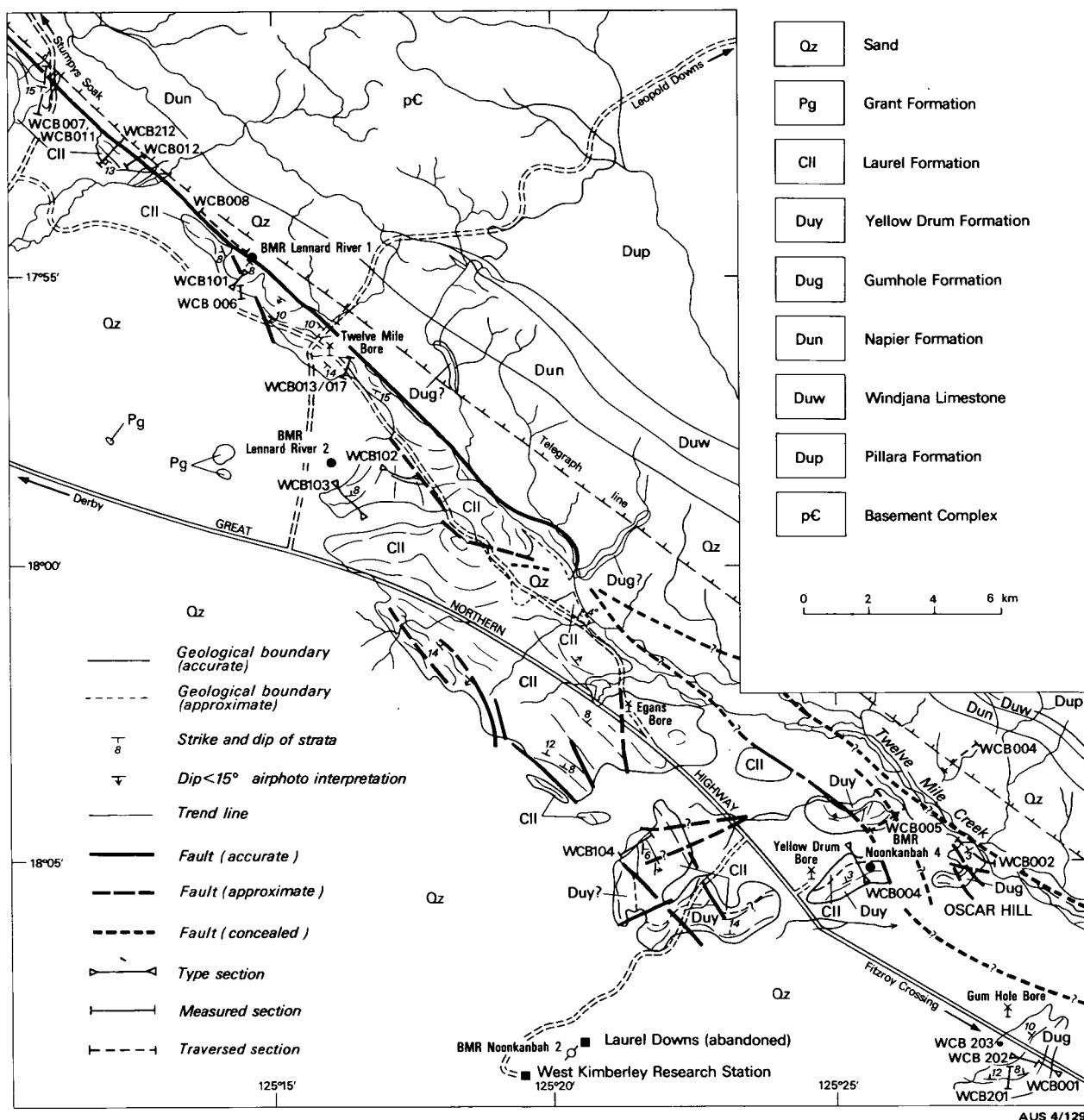


Fig. 5. Geology of the Fairfield Group, Oscar Hill area.

from what we now recognise as the Laurel Formation. Samples DF 10-3 and DF 10-5 are from a section which is equivalent to our section WCB 013. Glenister & Klapper identified *?Scaphignathus velifera* Helms from DF 10-3 and *Spathognathodus aculeatus* Branson & Mehl from sample DF 10-5. Sample GSWA 3240 contains the above named species and *Palmatolepis glabra* and *Prioniodina? smithi*. Beinert et al. (1971) referred the Glenister & Klapper (1966) identification of *?Scaphignathus velifera* to *Clydagnathus cavusformis*, and of *Spathognathodus aculeatus* to *S. plumulus plumulus*.

The apparent conflict in the age of sample GSWA 3240 (*Palmatolepis glabra* and *Prioniodina? smithi* indicate Late Devonian and *Clydagnathus cavusformis* and *Spathognathodus plumulus plumulus* Early Carboniferous) as pointed out by Roberts et al. (1972) is not resolved because our recovered faunas contained no

specimens restricted to the Devonian. It is possible that laboratory contamination of the original sample may have introduced Devonian forms into a Carboniferous sample.

The only subsequent report of Carboniferous conodonts is from the Fitzroy Trough (Bischoff *vide* Jones, Campbell, & Roberts, 1973) in Yulleroo No. 1 and Barlee No. 1 Wells. Three separate faunas were recovered from Yulleroo No. 1 Well; the earliest included *Polygnathus communis carinus* Hass and *Siphonodella* cf. *S. quadruplicata* (Branson & Mehl, 1934), the middle fauna yielded *Spathognathodus costatus* (*sensu* Rhodes, Austin, & Druce), and the youngest contained *Cavusgnathus unicornis* (Youngquist & Miller) and *Spathognathodus scitulus* (Hinde). The two lower faunas are Tournaisian, the upper is Viséan. Jones et al. (1973) also reported late Viséan to early Namurian conodonts from Barlee No. 1 Well.

FAIRFIELD GROUP CONODONTS

FAUNA

A total of 3692 conodont elements were identified to the species level from 580 samples collected for this study. Sample size ranged between 2 and 3 kg, with 3

kg of rock processed for most samples. The number of specimens identified to species level from each of the units studied is shown in Table 1. For the Fairfield Group the conodont recovery is 2.1 elements per kilogram. By comparison, Druce (1969) obtained an average of 5 elements per kilogram from the Devonian and Carboniferous rocks of the Bonaparte Gulf Basin.

TABLE 1. DISTRIBUTION AND RELATIVE ABUNDANCE OF CONODONT ELEMENTS IN THIS STUDY. FIGURES DO NOT INCLUDE FRAGMENTAL MATERIAL THAT WAS NOT IDENTIFIED TO SPECIES LEVEL.

	'birdseye limestone'	Gum- hole	Yellow Drum	Laurel	Totals
Number of samples	22	229	77	252	580
Barren samples	19	68	50	70	207
Conodonts identified to species level	53	1353	46	2240	3692
Average conodonts/kg	0.8	1.97	0.2	2.96	2.12

The conodont fauna of the three units studied, the Gumhole and Laurel Formations and the Yellow Drum Sandstone, is relatively impoverished, in terms of both element abundance and faunal diversity. Thompson (1967) in a study of Osagean (Lower Mississippian) rocks from southwestern Missouri found an average of 15 conodont elements per kilogram and Nicoll (1971) found an average of 8 elements per kg, including 124 barren samples, from Mississippian rocks in southern Indiana.

Druce (1969) recognised 159 element taxa from the Upper Devonian and Lower Carboniferous of the Bonaparte Gulf Basin in Western Australia. In the present study we recognise 59 taxa of which 33 are com-

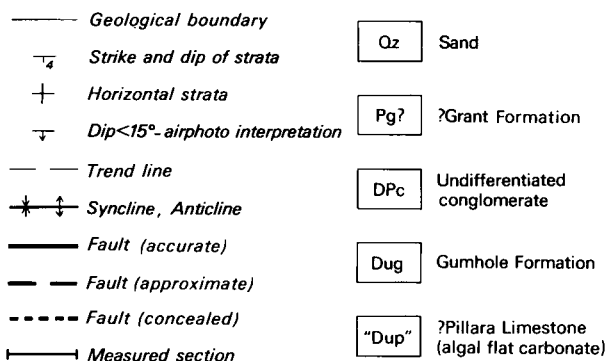
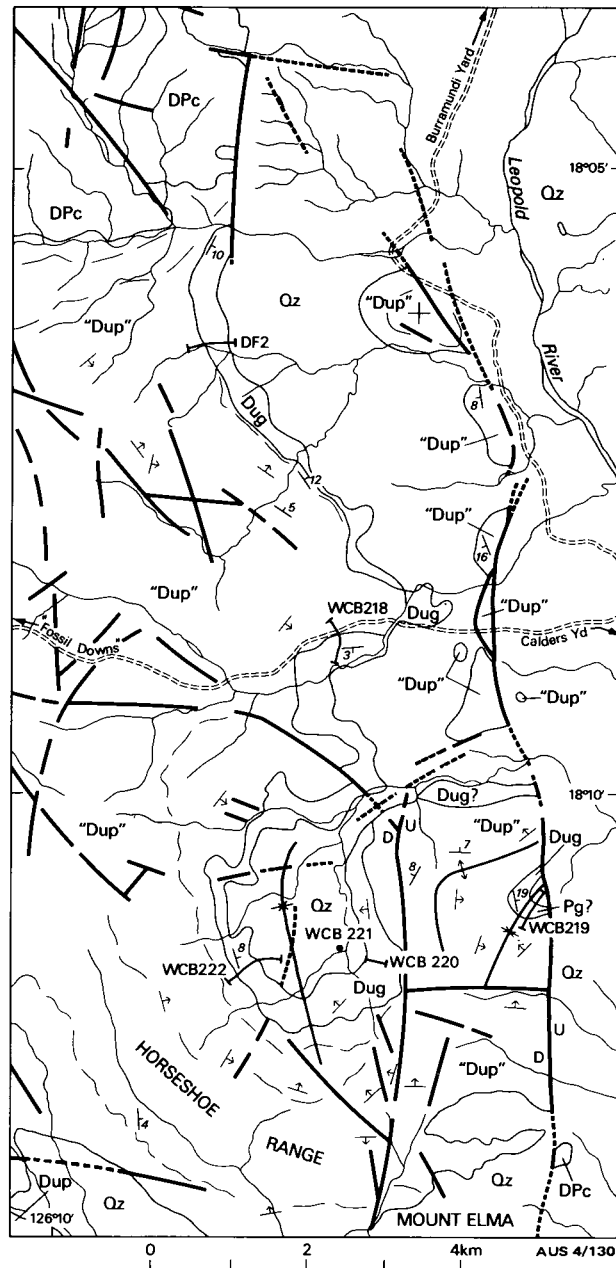


Fig. 6. Geology of the Fairfield Group, Horseshoe Range area.

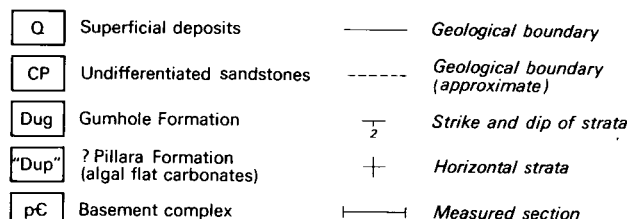
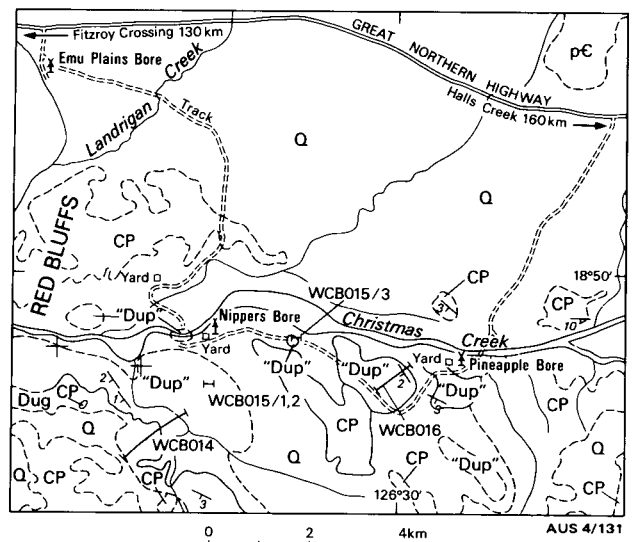


Fig. 7. Geology of the Fairfield Group, Red Bluffs area.

AGE	TEICHERT, 1949	THOMAS, 1957, 1959 GUPPY et al., 1958	VEEVERS & WELLS 1961	PLAYFORD & LOWRY 1966	ROBERTS et al., 1974 JONES et al., 1974	DRUCE & RADKE 1979	GROUP
TOURNAISIAN (part)	not recorded	not recorded	not recorded	not recorded		SHALE MEMBER	GROUP
		LAUREL BEDS	LAUREL FORMATION		LAUREL FORMATION	LAUREL FORMATION	
FAMENNIAN (part)	PRODUCTELLA LIMESTONE	?		FAIRFIELD FORMATION		YELLOW DRUM SANDSTONE	FAIRFIELD GROUP
		FAIRFIELD BEDS	FAIRFIELD BEDS		FAIRFIELD BEDS	GUMHOLE FORMATION	
		BUGLE GAP LIMESTONE (part)	BUGLE GAP LST (part)	PIKER HILLS FORMATION	PIKER HILLS FORMATION	PIKER HILLS FORMATION	
			NAPIER FM + OTHERS (part)	BUGLE GAP LST	BUGLE GAP LST	BUGLE GAP LST	
				VIRGIN HILLS FM	VIRGIN HILLS FM	VIRGIN HILLS FM	
				NAPIER FM	NAPIER FM	NAPIER FM	
				PILLARA LST	PILLARA LST	PILLARA LST	
						"PILLARA LIMESTONE"	
						LULUIGUI "EQUIVALENT"	
						LATE FAMENNIAN BIRDSEYE LST	
						"REEF COMPLEX" (part)	

AUS 4/132

Fig. 8. Time-stratigraphic interpretations of the Fairfield Group.

mon to the Bonaparte Gulf Basin. This difference in numbers of taxa between the two basins is due, in part, to the slightly longer time range of rocks in the Bonaparte Gulf Basin, but there are still markedly fewer taxa from Canning Basin rocks of equivalent time range. This may indicate that the palaeoenvironments in the Canning Basin were less favourable to the conodont organism than those of the Bonaparte Gulf Basin.

BIOSTRATIGRAPHIC ZONATION

Because the Canning Basin conodont fauna has a high component of endemic species and because stratigraphic ranges appear to be different from ranges observed by Druce (1969) in the Bonaparte Gulf Basin we cannot recognise the Bonaparte Gulf zonation. Therefore we have recognised six assemblage zones in the uppermost Devonian-Lower Carboniferous of the Canning Basin; their correspondence to the established zones of the Bonaparte Gulf Basin is shown in Figure 13.

Specimen abundance is low in most of the samples examined, and this means that the reliability of recorded first and last occurrences as indicators of true taxa range in the studied sections is low. For this reason we have tended to draw the boundaries between assemblage zones not at the last occurrence of a taxon but at a point between that last occurrence and the first occurrence of a succeeding taxon.

Polygnathus communis collinsoni Assemblage Zone

The *Polygnathus communis collinsoni* A.Z. is recognised in the lower part of the Gumhole Formation. The zone is characterised by several species, including *Pelekysgnathus australis*, *Spathognathodus acidentatus*, *S. mehlbrai*, *S. crassidentatus*, and *Polygnathus communis collinsoni*, of which only the last is confined to the

zone. The base of the zone is not defined in this study but is taken as the first appearance of *S. acidentatus* and *S. mehlbrai*. The upper limit is taken as just below the first appearance of *Bispathodus zieglerei* and *Icriodus platys*.

Icriodus platys Assemblage Zone

The *Icriodus platys* A.Z. is present in the upper part of the Gumhole Formation and the lowermost part of the Yellow Drum Sandstone. The zone is characterised by the presence of *Pelekysgnathus australis*, *Spathognathodus acidentatus*, *S. mehlbrai*, *S. crassidentatus*, all of which range beyond the zone, and *Bispathodus zieglerei*, *Spathognathodus?* sp. nov. A, *Icriodus platys*, *Acodina* sp. A, *Acodina* sp. B, *Hibbardella?* helmsi, and *Hibbardella* (*Hibbardella*) sp. nov. Druce 1969, which are restricted to the zone.

The base of the *Icriodus platys* A.Z. is at the first appearance of *I. platys* or *B. zieglerei*. The top of the zone is marked by the last appearance of *Pelekysgnathus australis* and *Spathognathodus acidentatus*, and below the first appearance of *Clydagnathus gilwernensis* and *Bispathodus aculeatus plumulus*.

Clydagnathus gilwernensis Assemblage Zone

The *Clydagnathus gilwernensis* A.Z. occurs in the upper part of the Yellow Drum Sandstone and the basal few metres of the Laurel Formation. The lower boundary is marked by the first appearance of *Clydagnathus gilwernensis*, with *C. cavusformis*, *Polygnathus communis communis*, *Bispathodus aculeatus plumulus*, *Pseudopolygnathus* cf. *Ps. dentilineatus* and *Anchignathodus cristulus* appearing also. *Patrognathus* sp. A, *Polygnathus* aff. *P. lacinatus*, and ?*P.* sp. A are confined to the zone. The top of the zone is defined as just below first occurrence of Apparatus A.

ASSEMBLAGE ZONES	UPPER DEVONIAN (part)			LOWER CARBONIFEROUS (part)			
	"birdseye limestone"	GUMHOLE FORMATION		YELLOW DRUM FM	LAUREL FORMATION		
	zones not defined	POLYGNATHUS COMMUNIS COLLINSONI	ICRIODUS PLATYS	CLYDAGNATHUS GILWERNENSIS	APPARATUS A	SPATHOGNATHODUS CANNINGENSIS	BISPATHODUS SPINULICOSTATUS
<i>Icriodus platys</i>			—————				
<i>Pelekysgnathus australis</i>			—————				
Apparatus A					—————		
<i>Acodina</i> sp. A			—————				
<i>Acodina</i> sp. B		———					
<i>Anchignathodus cristulus</i>					—————		—————
<i>Angulodus compressa</i>			—————	—————	—————		
<i>Angulodus pergracilis</i>		—————	—————	—————	—————		—————
<i>Apatognathus</i> sp.			———				
<i>Bispathodus aculeatus aculeatus</i>					—————		
<i>Bispathodus aculeatus plumulus</i>				—————	—————		—————
<i>Bispathodus spinulicostatus</i>							—————
<i>Bispathodus zieglerei</i>			———				
<i>Clydagnathus cavusformis</i>				—————	—————		
<i>Clydagnathus gilwernensis</i>				—————	—————		—————
<i>Dinodus</i> sp.					———		
<i>Gnathodus</i> sp.							———
<i>Hibbardella brevialata</i>						———	
<i>Hibbardella? helmsi</i>			———				
<i>Hibbardella</i> cf. <i>H. insignis</i>		—————		—————	—————		—————
<i>Hibbardella</i> cf. <i>H. micra</i>			—————				
<i>Hibbardella</i> (H) sp. nov.			—————				
<i>Hindeodella acuta</i>							—————
<i>Hindeodella brevis</i>		—————	—————	—————			
<i>Hindeodella corpulenta</i>		—————					
<i>Hindeodella subtilis</i>			—————	—————			
<i>Hindeodella</i> sp. nov. A				—————	—————		—————
<i>Hindeodella</i> sp. nov. B		—————	—————	—————	—————	—————	———

Ligonodina platys
Neoprioniodus cf. *N. alatoideus*
Neoprioniodus alatus
Neoprioniodus barbatus
Neoprioniodus sp. nov. A
Ozarkodina abnormis
Ozarkodina flexa
Ozarkodina cf. *O. plana*
Ozarkodina rhenana
Ozarkodina sp. A
Patrognathus sp. A
Polygnathus burtensis
Polygnathus communis collinsoni
Polygnathus communis communis
Polygnathus inornatus
Polygnathus aff. *P. lacinatus*
Polygnathus thomasi
?Polygnathus sp. A
Prioniodina? *symmetrica*
Pseudopolygnathus cf. *Ps. dentilineatus*
Pseudopolygnathus multistriatus
Pseudopolygnathus cf. *Ps. nodomarginatus*
Siphonodella cf. *S. cooperi hassi*
Spathognathodus acidentatus
Spathognathodus canningensis
Spathognathodus crassidentatus
Spathognathodus mehlbrai
Spathognathodus cf. *S. robustus*
Spathognathodus? sp. nov. A
Synprioniodina regularis
 Gen. et sp. indet. A

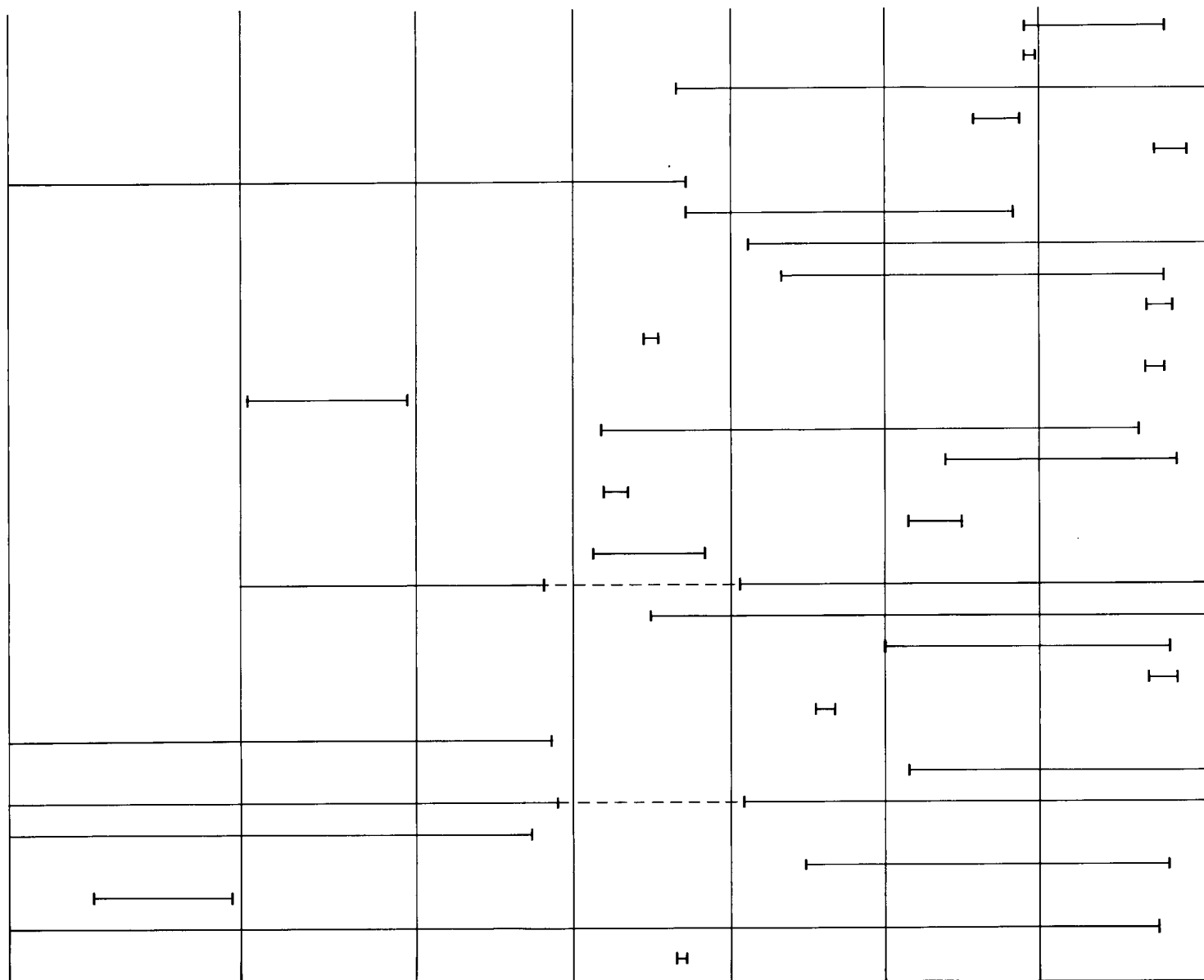
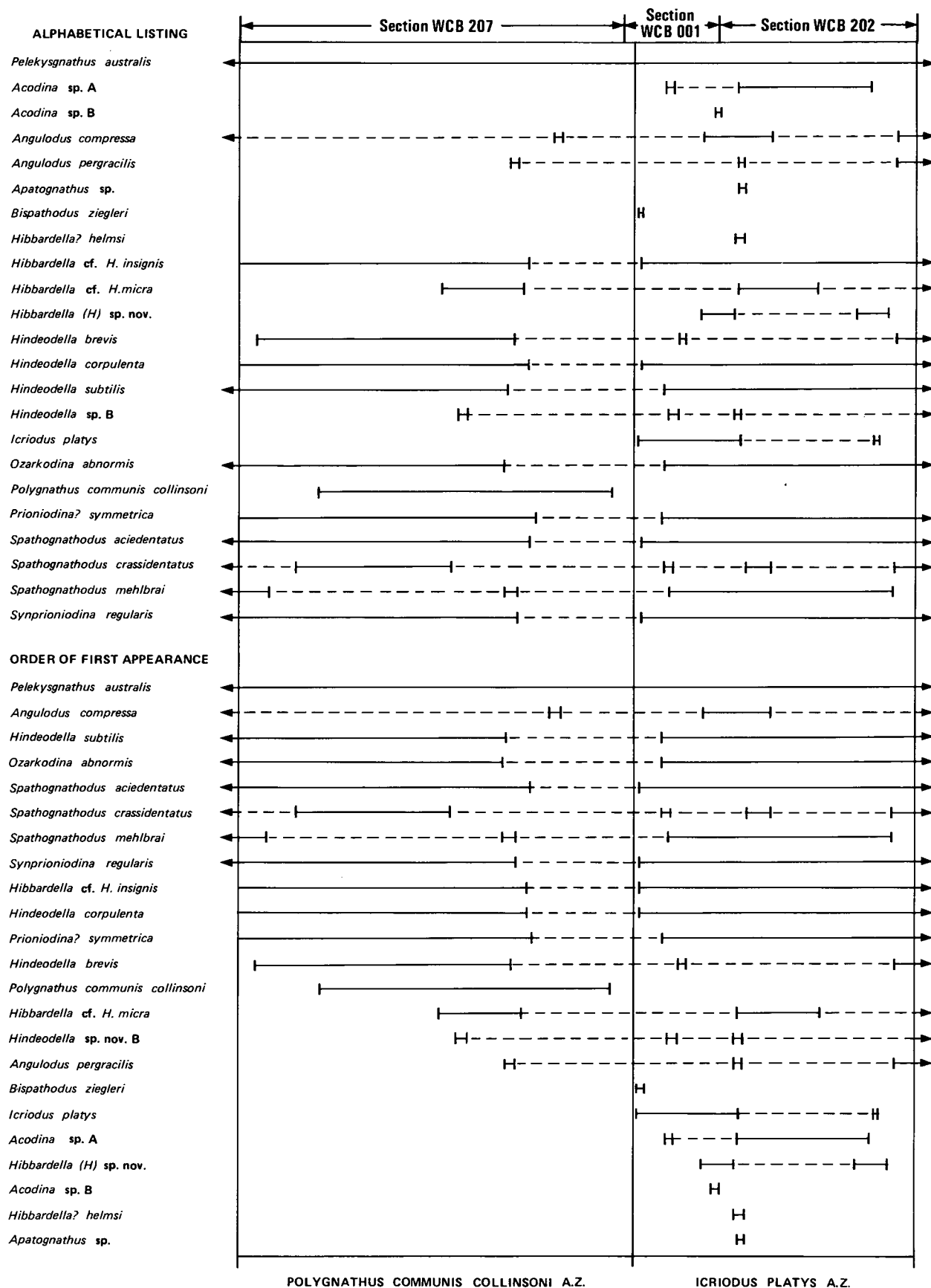


Fig. 9. Range chart of the conodont species arranged alphabetically.



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Fig. 10. Composite range chart of conodont species from the Gumhole Formation.

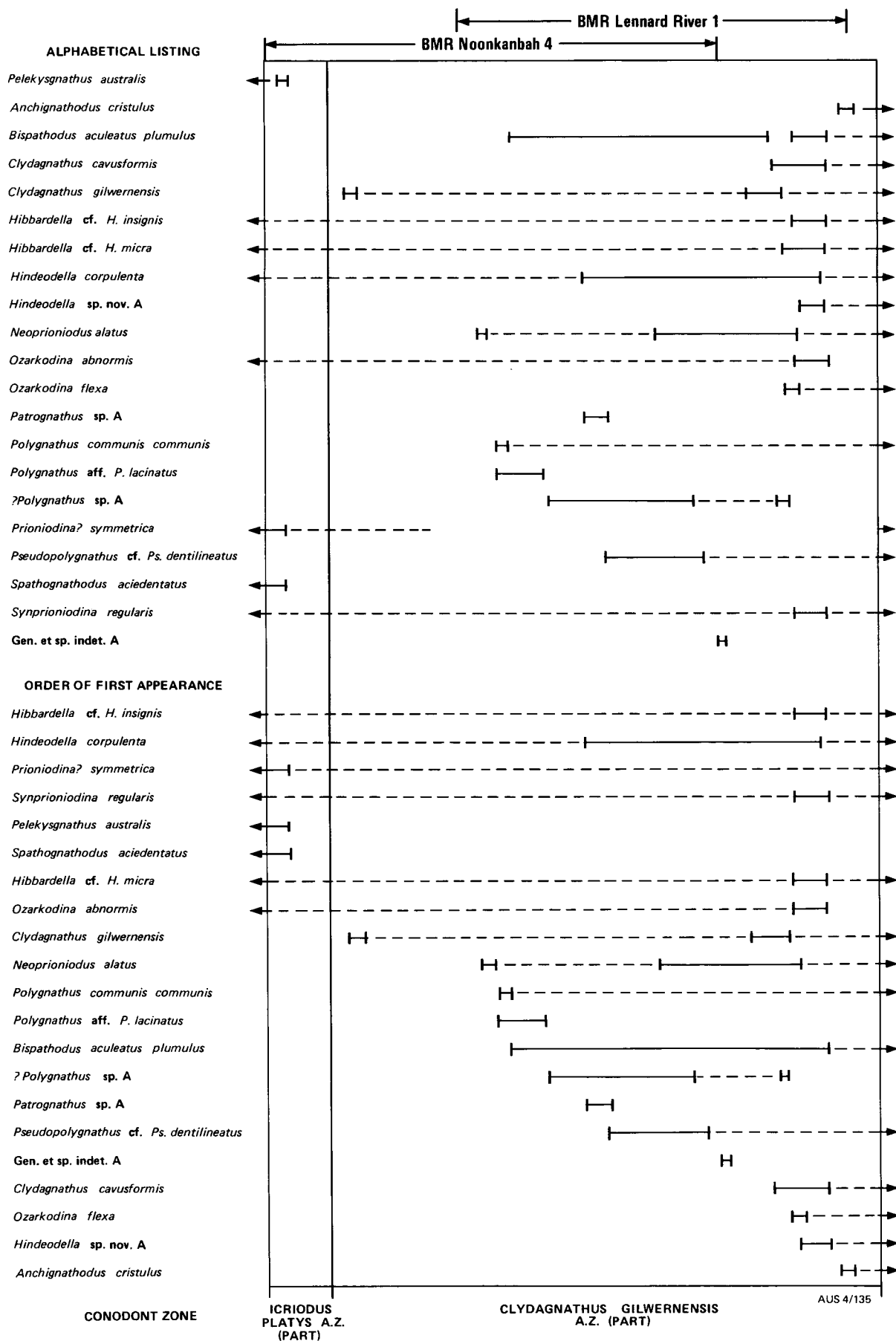
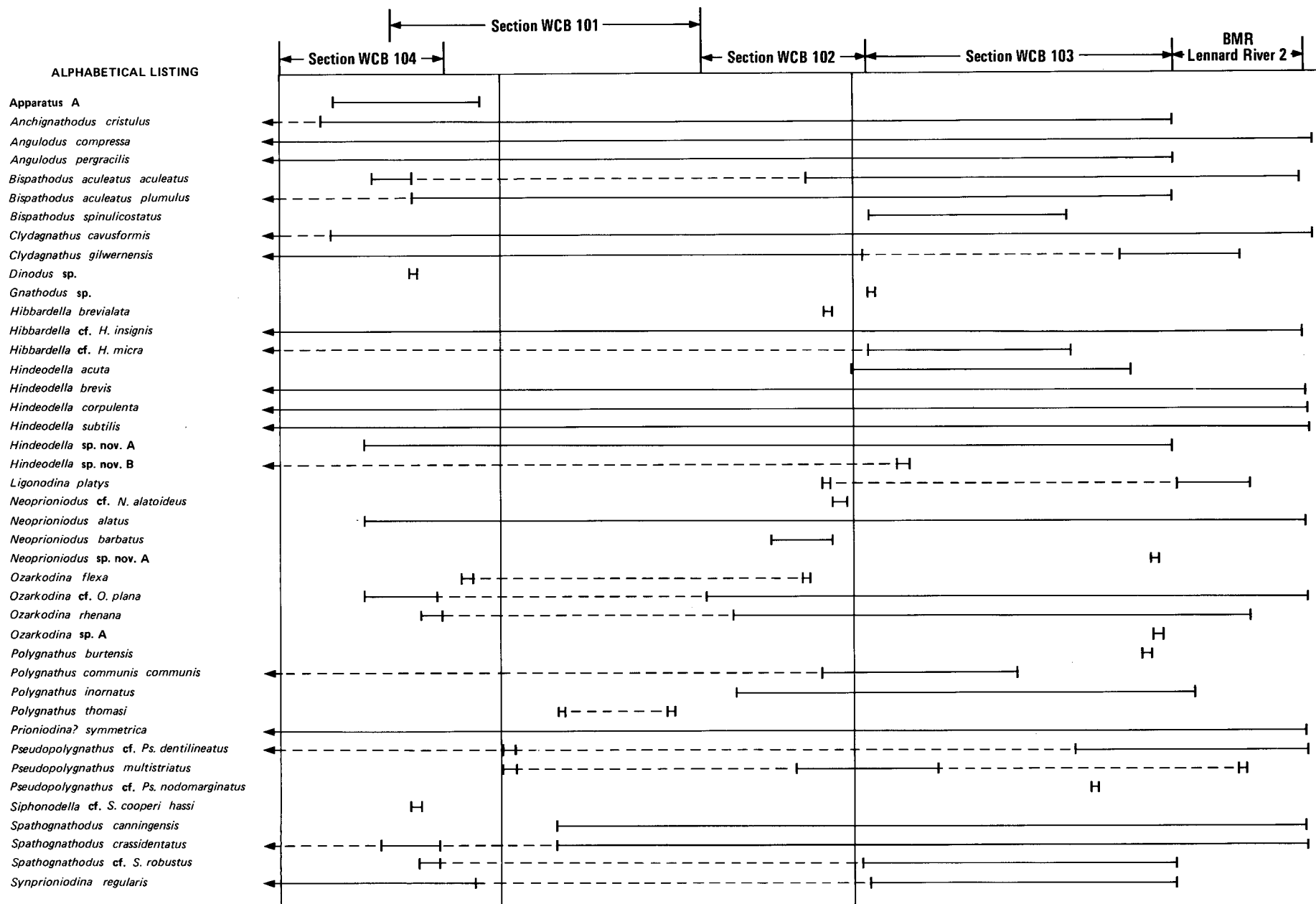


Fig. 11. Composite range chart of conodont species from the Yellow Drum Sandstone.



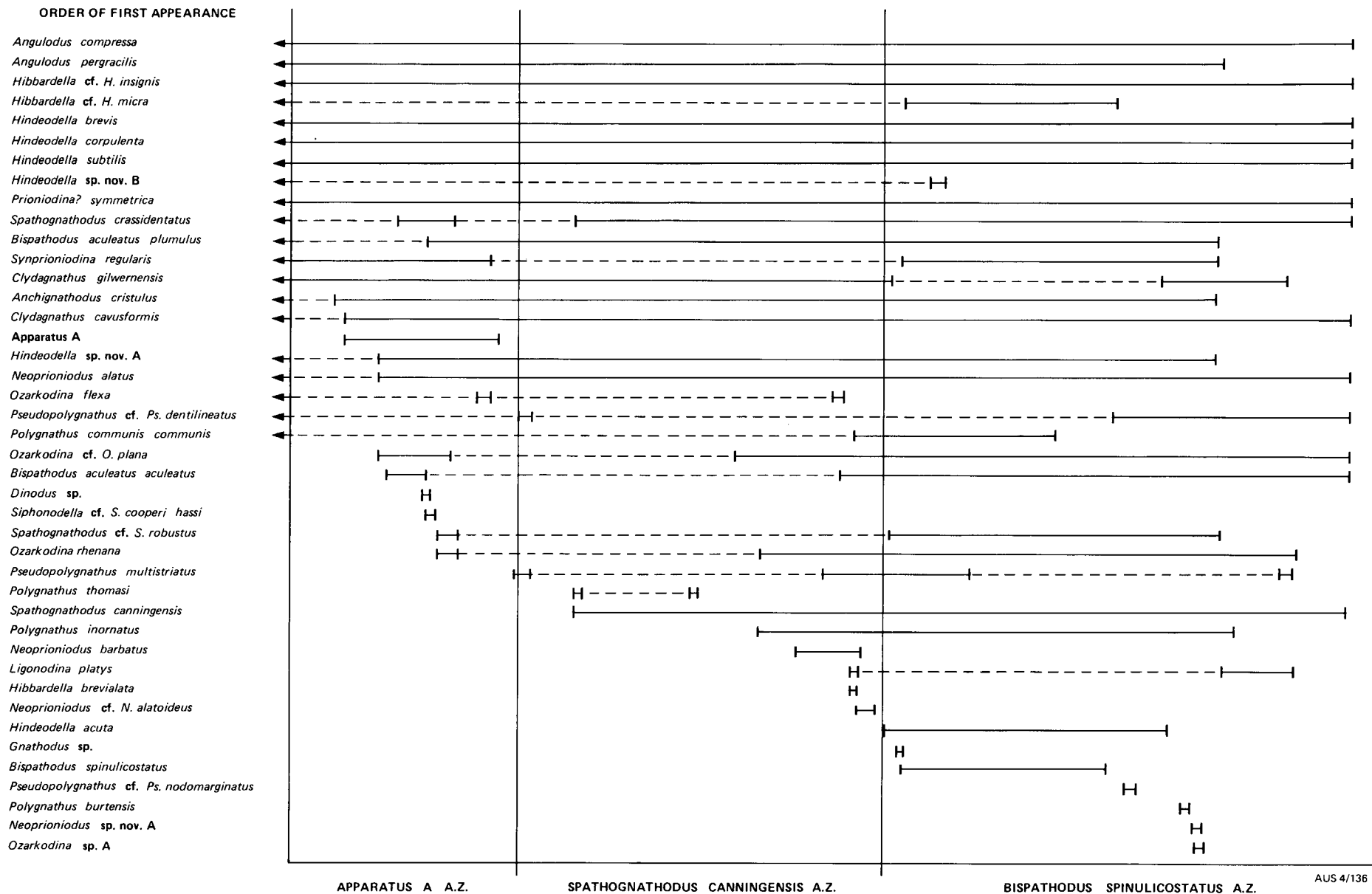


Fig. 12. Composite range chart of conodont species from the Laurel Formation.

		CANNING BASIN, WA this report	BONAPARTE GULF BASIN, WA Druce, 1969	NEW SOUTH WALES Jenkins, 1974	MISSOURI Thompson & Fellows, 1970	BELGIUM Austin, 1973; Conil & Lys, 1970		
CARBONIFEROUS	cu II α	LAUREL FORMATION	SEPTIMUS LIMESTONE	<i>Pseudopolygnathus nodomarginatus</i>	<i>Scaliognathus anchoralis</i>	<i>Bactrognathus</i> – <i>Pseudopolygnathus multistriatus</i>	<i>Scaliognathus anchoralis</i>	TN 3c
				<i>Spathognathodus costatus</i>	<i>Gnathodus</i> sp. A		<i>Polygnathus communis carinus</i>	TN 3b
				<i>Spathognathodus canningensis</i> A. Z.	<i>Spathognathodus tridentatus</i>	<i>Gnathodus semiglaber</i>	<i>Gnathodus semiglaber</i> – <i>Polygnathus communis carina</i>	TN 3a
					<i>Gnathodus punctatus</i>	<i>Gnathodus punctatus</i> – <i>Siphonodella cooperi hassi</i>	Interzone	
	cu I	YELLOW DRUM FORMATION	BURT RANGE FORMATION	Enga <i>Clydagnathus nodosus</i>	<i>Siphonodella</i> spp.			TN 2
				<i>Siphonodella zones</i>	-----	<i>Siphonodella zones</i>		
				<i>Spathognathodus plumulus</i>		-----		TN 1b
							(<i>Protognathodus</i>)	
	do VI	GUMHOLE FORMATION	NINGBING LIMESTONE (upper part)	<i>Icriodus platys</i> A. Z.	Zones	Zones		TN 1a
				?	zones		<i>Spathognathodus costatus</i>	Fa 2d
<i>Polygnathus communis collinsoni</i> A. Z.				not	not		Fa 2c	
?				established	established		?	?
DEVONIAN	do V							
	?	"birdseye limestone"						

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Fig. 13. Devonian and Carboniferous correlation (selected areas).

Apparatus A Assemblage Zone

The Apparatus A A.Z. is present in the lower part of the Laurel Formation. Characteristic species from the zone include Apparatus A, *Siphonodella* cf. *S. cooperi hassi*, *Clydagnathus cavusformis*, *C. gilwernensis*, *Anchignathodus cristulus*, and *Bispathodus aculeatus plumulus*. Only Apparatus A and *Siphonodella* cf. *S. cooperi hassi* are confined to the zone. The zone is defined by the range of Apparatus A.

Spathognathodus canningensis Assemblage Zone

The *Spathognathodus canningensis* A.Z. is developed in the middle part of the Laurel Formation. Characteristic species of the zone include *Polygnathus thomasi*, *Neoprioniodus barbatus*, *N.* cf. *N. alatoideus*, all restricted to the zone, as well as *Spathognathodus canningensis*, *Bispathodus aculeatus plumulus*, *Pseudopolygnathus multistriatus*, *Ps.* cf. *dentilineatus*, *Clydagnathus cavusformis*, and *C. gilwernensis*. The base of the zone is defined by the first occurrence of *Ps. multistriatus* and *P. thomasi*. *S. canningensis* first appears just above the base of the zone. The top of the zone is just below the first occurrence of *Bispathodus spinulicostatus*.

Bispathodus spinulicostatus Assemblage Zone

The *Bispathodus spinulicostatus* A.Z. occurs in the uppermost part of the Laurel Formation, and represents the youngest material collected in this study. For this reason no upper limit is placed on the range of species found in this zone. Characteristic species of the *B. spinulicostatus* A.Z. include *Hindeodella acuta*, *B. spinulicostatus*, *Pseudopolygnathus* cf. *Ps. nodomarginatus*, and *Polygnathus burtensis*, all restricted to the zone, as well as *Spathognathodus canningensis*, *Bispathodus aculeatus aculeatus*, *Bispathodus aculeatus plumulus*, *Ps. multistriatus*, and *Ps.* cf. *Ps. dentilineatus*. The base of the zone is defined by the first occurrence of *B. spinulicostatus*.

BIOSTRATIGRAPHIC CORRELATION

Devonian

The conodont fauna of the Gumhole Formation and the lowermost portion of the Yellow Drum Sandstone is of Late Devonian age. The fauna is not highly diverse and is composed largely of long-ranging forms. The faunal elements of stratigraphic value within the basin are largely endemic and cannot be used for correlation farther afield. A second major problem is the lack of a single section that contains both of the major zonal indicators, viz. *Icriodus platys* and *Polygnathus communis collinsoni*. We believe on the basis of stratigraphic interpretation that the two zones are sequential and that *P. c. collinsoni* is older than *I. platys*, but firm evidence for this belief is lacking. It is possible, but not probable, that the two species are facies-controlled and could be lateral equivalents. Figure 13 shows our correlation of the Fairfield Group with selected sequences elsewhere.

The *Polygnathus communis collinsoni* A.Z. is probably equivalent to the late doIV to middle doV of the German Ammonoid Stufen. This correlation is based on the stratigraphic association *P. c. collinsoni* and *Palmatolepis gracilis gracilis* in the Bonaparte Gulf and Canning Basins (Druce, 1969; 1976), where *P. c. collinsoni* is associated with doV forms in the Ningbing and Piker Hills Limestones. Other elements in this zone

are either long-ranging or do not have well documented stratigraphic distribution.

The *Icriodus platys* A.Z. represents the youngest Devonian fauna in this study, and most elements are either long-ranging or endemic. A single specimen of *Bispathodus ziegleri* occurs near the base of the zone, indicating a doVI or late doV age. On the other hand, *Icriodus platys* may be conspecific with the specimen illustrated as Nov. gen. nov. sp. B by Bouckaert & Ziegler (1965) from sample 62 of the Esneux section 177. In the Namur Symposium Guidebook (Bouckaert & Streel, 1974, excursion D, p. D8) this sample is placed in the informal micropaleontological guide mark (M.g.m.) number 36 which, if the identification is correct, would correlate our material to the lower *Scaphignathus veliferus* Zone (late doIII_a of Germany). However, we prefer to put emphasis on *B. ziegleri* and correlate our *I. platys* A.Z. with Fa2d or Tn1a in the Belgium zonation (late doV-doVI of Germany). If *I. platys* is conspecific with Nov. gen. nov. sp. B. Bouckaert & Ziegler, then an extension of the range of the latter species into the *Spathognathodus costatus* Zone (= late doV-doVI) is implied.

The Devonian/Carboniferous boundary occurs in the lower part of the Yellow Drum Sandstone. It is marked by the loss of *Pelekyognathus australis* and the subsequent introduction of *Clydagnathus* and *Bispathodus aculeatus plumulus*. However, only two sections, WCB 010 and BMR Noonkanbah 4, span the boundary, and lack of fauna and poor exposure do not allow us to pinpoint the boundary in either section.

Carboniferous

As with the Devonian, the correlation of the Carboniferous portion of the Yellow Drum Sandstone and the Laurel Formation with Carboniferous sequences in Australia and elsewhere is made difficult by the absence of key biostratigraphic conodont elements in the Canning Basin. A tentative correlation of the Fairfield Group with selected sequences elsewhere is shown in Figure 13. The Yellow Drum-Laurel sequence appears to be roughly equivalent to the Burt Range Formation-Enga Sandstone-Septimus Limestone sequence in the Bonaparte Gulf but, although the basins are separated by only 450 km, there are endemic forms and apparent differences in stratigraphic range of some elements, which together make precise correlation difficult.

The *Clydagnathus gilwernensis* A.Z. is correlated with the early Tournaisian of Belgium. The virtual absence of *Siphonodella* and the total lack of *Protognathodus* make direct correlation with Belgian sections difficult. However, the presence of *Bispathodus aculeatus plumulus*, *Clydagnathus gilwernensis*, and *C. cavusformis* demonstrate that the lower part of the Carboniferous sequence of the Canning Basin corresponds to the *Patrognathus variabilis*-*S. plumulus* Zone in the lower part of the K Zone of the Avon Gorge section (Rhodes et al., 1969). This British zone, in turn, is correlated with the lower part of Tn1b of Belgium (Austin, Conil, Rhodes & Streel, 1970). However, the *Clydagnathodus gilwernensis* A.Z., like the coeval *Patrognathus variabilis*-*S. plumulus* Zone in Britain, lacks elements of the genus *Protognathodus*, which according to Alberti et al. (1974) mark the earliest Carboniferous in the type section for the Devonian/Carboniferous boundary at Stockum in the Rhenish Schiefergebirge. The absence of the *Protognathodus* fauna in our samples may be due to biofacies differences rather than indicating a break between Devo-

nian and Carboniferous deposition in the Canning Basin. There is no field evidence of an unconformity in the basin.

The Apparatus A A.Z. is correlated with the middle Tournaisian. The basis of this correlation is the presence of elements of Apparatus A (i.e. *Hibbardella* cf. *H. plana*, *Falcodus tortus*, *F. veeversi*) that are found in the *Siphonodella sulcata*-*Polygathus parapetus* A.Z. and up to the lower part of the *Clydagnathus nodosus* Assemblage Zone in the Bonaparte Gulf Basin (Druce, 1969), and the presence in our lower Laurel Formation samples of a single specimen of *Siphonodella* cf. *S. cooperi hassi* Thompson & Fellows. This establishes a rough correlation of the Apparatus A A.Z. with the *Siphonodella* Assemblage Zones in Europe, North America, and eastern Australia (Jenkins, 1974). The top of the Apparatus A A.Z. thus corresponds approximately with the top of the Tn2c of Belgium.

The *Spathognathodus canningensis* and *Bispathodus spinulicostatus* Assemblage Zones correspond to the late Tournaisian of Belgium. There is no firm basis on which to correlate the *S. canningensis* A.Z. to the type Belgian sequence other than its stratigraphic position and the lack of *Siphonodella*. The *B. spinulicostatus* A.Z. is correlated with the *Pseudopolygnathus nodomarginatus* Assemblage Zone of the Bonaparte Gulf Basin (Druce, 1969, p. 33) and the *Scaliognathus anchoralis* Zone in New South Wales (Jenkins, 1974) on the first occurrence of *Ps. nodomarginatus* and the presence of *B. spinulicostatus*. Using the presence of *Sc. anchoralis* and *Ps. cf. nodomarginatus* in New South Wales we correlate our uppermost zone with the *Sc. anchoralis* Zone, the latest of the Tournaisian zones in Belgium. It is possible that the uppermost Laurel Formation is as young as earliest Viséan, but the conodont evidence is equivocal.

SYSTEMATIC PALAEOONTOLOGY

Three multi-element taxa are listed first and then the form genera and form species from this study are listed alphabetically. All specimens are deposited in the Commonwealth Palaeontological collection (CPC), Bureau of Mineral Resources, Canberra.

In the descriptions the following conventions have been followed: cone types have been orientated with the long axis of the cone vertical; platform elements have been orientated with the blade anterior, and left and right are defined on a specimen looking down on the oral surface with the blade directed away from the observer. I elements are orientated with the narrow blade end anterior and the major cusp or denticle posterior. In those cases where tabulation has been made for some morphological feature of a species the numbers in parenthesis (19/64) indicate firstly the number of specimens observed to have the feature (i.e. 19) and secondly the number of specimens on which the feature could have been observed (i.e. 64).

Multi-element and discrete element taxonomy

The current trend in conodont studies is towards the recognition of whole-animal, or apparatus, associations based either on statistical or some less well defined and perhaps largely intuitive association of elements. In this study we have not applied statistical tests to our material, but we have recognised two apparatuses on the basis of similarity of ranges and on morphologic criteria. We have named two of the taxa *Icriodus platys* and *Pelekysgnathus australis*, and left the third in open nomenclature (Apparatus A).

MULTI-ELEMENT TAXONOMY

Genus *Icriodus* Branson & Mehl, 1934

Type species: Icriodus alternatus Branson & Mehl, 1934.

Icriodus platys sp. nov.

Pl. 12, figs. 3-5, 7

Derivation of name: From the Greek *platys*, broad and flat.

Diagnosis: I, S₁; the I element is icriodontan and the S₁ element is modified sagittodontan.

I element

Material studied: 70 specimens.

Description: An I element with expanded oral platform

surface, prominent posterior denticle and asymmetrical lachrymiform basal cavity. The oral surface of most specimens has a distinct central denticle row and randomly arranged lateral nodes or ridges. The central nodal row is indistinct in those specimens with very complex convoluted lateral ridges. Lateral ornament may consist of distinct nodes (8/68—12%), usually observed in juvenile specimens, or ridges (54/68—79%) oriented perpendicular to the long axis of the specimen. In a few specimens (6/68—9%) these ridges are very complex and convoluted. The oral platform of most specimens is either roughly symmetrical (28/63—44%) or slightly asymmetrical (29/63—46%). A few (6/63—10%) of the specimens are highly asymmetrical.

The posterior enlarged denticle is subrounded (36/51—71%) to angular (12/51—23%) in cross-section with only a few specimens (3/51—6%) of oval cross-section. The denticle is usually centred (50/57—88%) along the central axis but may be located to one side (7/57—12%). It is connected to the oral surface platform by a ridge which is an extension of the nodal row, but the denticle is usually separated from the lateral rows by grooves on either one side (15/56—27%) or both sides (40/56—71%) of the platform. The denticle projects both above and posteriorly from the platform surface in all except two (2/50—4%) specimens. In most cases (28/50—56%) the denticle is long, but in the rest (20/50—40%) it is short. The denticle usually (43/53—81%) has ribs on the posterior aboral surface but a few specimens (10/53—19%) are smooth.

The aboral surface has a typical icriodont basal cavity that becomes wider and deeper toward the posterior margin. The specimens are about evenly divided between right (34/66—51%) and left (32/66—49%) forms. The apex of the basal cavity is difficult to observe in most specimens because of the thickness of the specimens and the presence of foreign material in the cavity. In two specimens, however, the basal cavity has a double apex similar to that observed in *Pelekysgnathus australis*.

Remarks: This species is distinct from other upper Devonian icriodonts except for a specimen illustrated by Bouckaert & Ziegler (1965, p. 26, pl. 5, figs. 9-11). Their specimen is similar to some of our larger speci-

I element only	I + 1 cone element	I + 2 cone elements	I + 3 cone elements
I 17	I + S ₂ 9 I + M _{2a} 5 I + M _{2b} 12 total 26	I + S ₂ + M _{2a} 5 I + S ₂ + M _{2b} 10 I + M _{2a} + M _{2b} 4 total 19	I + S ₂ + M _{2a} + M _{2b} 13
I absent	S ₂ 10 M _{2a} 9 M _{2b} 14 total 33	S ₂ + M _{2a} 3 S ₂ + M _{2b} 5 M _{2a} + M _{2b} 1 total 9	S ₂ + M _{2a} + M _{2b} 2

Fig. 14. Abundance and grouping of the different elements of the *Pelekysgnathus australis* animal. Numbers refer to the number of samples from which each combination of elements was recovered.

mens. It is possible that *I. platys* has developed from *Pelekysgnathus australis* with the development of lateral denticle (nodal) rows. The general morphological similarity to *P. australis*, including the dual tipped basal cavity and the ridges on the posterior denticle, could indicate its evolution from that species.

Figured specimens: CPC 15921 (WCB 218/5), 15922 (WCB 218/5) Holotype, 15923 (WCB 001/9), 15924 (WCB 002/6).

Range: *Icriodus platys* A.Z.

S₁ element

Material studied: 4 specimens.

Remarks: This element is an S₁ element, in the symbols of Klapper & Philip (1971) and as such is part of a Type 4 apparatus belonging to the family Icriodontidae. The element is part of the *Icriodus platys* apparatus but only a few specimens were found in this study. Our specimens are morphologically similar to specimens assigned by Klapper & Philip (1972, p. 103, Pl. 4, figs. 11, 13, 14, 17) to *Pedavis* n. sp. B (S₁ element).

Figured specimens: CPC 15919 (WCB 002/12), 15920 (WCB 002/12).

Range: Within the *Icriodus platys* A.Z.

Genus *Pelekysgnathus* Thomas, 1949

Type species: *Pelekysgnathus inclinatus* Thomas, 1949.

Pelekysgnathus australis sp. nov.

Derivation of name: australis, for Australia.

Diagnosis: Type 4 apparatus of Klapper & Philip. Elements recognised are I, S₂, M_{2a}, M_{2b}. I element is pelekysgnathiform.

Remarks: Klapper & Philip (1972, p. 101) recognised apparatus species of the family Icriodontidae as composed of three elements: I, S₂, and M₂. Our findings confirm theirs but add an additional cone element. This apparatus thus consists of four elements: one platform element (I) and three cone type elements (S₂, M_{2a}, M_{2b}). The two cone elements S₂ and M_{2a} were described by Mound (1968) as *Drepanodina lachrymosa* and *Oneotodus circularis* respectively. The third cone element, M_{2b}, may have been illustrated by Mound (see below) but was not distinguished from *O.*

circularis. The I element is distinct from the form species of *Pelekysgnathus* described by Mound and so we have erected a new species. One or more of these elements are found in a total of 119 samples. The breakdown of distribution and association is shown in Figure 14.

The large number of samples containing the I element and two or three cone elements as compared with other combinations would seem to support the association of these form species inferred from morphologic similarity. The major morphologic criteria of association are the similarity of aboral outline and symmetry of the I and S₂ elements as well as the tendency for all elements to have well developed striations.

Range: Unnamed zone ('birdseye limestone') to *Icriodus platys* A.Z.

I element

Pl. 1, figs. 1-7

1966 *Pelekysgnathus* sp. Glenister & Klapper, p. 826, pl. 95, fig. 10.

Material studied: 189 specimens.

Description: A typical pelekysgnathiform element with double basal cavity, a prominent posterior denticle, and single anterior denticle row. The total number of denticles on the oral surface ranges from two to nine (mean 5.1, std. dev. 1.16) [Maple Mill Shale, U.S.A., —36 specimens—mean 6.8, std. dev. 0.75—see below]. In lateral view the oral surface appears horizontal in most (100/112—89%) specimens and the anterior end is vertical. In a few specimens (12/112—11%) the height of the denticles gradually decreases anteriorly (Pl. 1, fig. 1). Except for three examples the anterior denticles are discrete. The posterior is marked by the presence of one (117/146—80%) or two (29/146—20%) enlarged denticles. These denticles may be either erect 68/136—50%) or posteriorly inclined (68/136—50%) and usually (121/142—85%) project above the level of the anterior denticle row. The posterior margin may either be smooth (101/153—66%) or bear several small ribs or ridges (52/153—34%) (Pl. 1, fig. 6). The cross-sectional shape of the posterior denticle(s) is usually rounded to oval (107/153—75%) but some specimens (46/153—25%) show distinct lateral compression. The basal cavity is lachrymi-

form and usually (154/165—93%) singular, but 11 specimens have a medial constriction that gives the cavity outline a pinched waist shape. The specimens are unevenly divided between apparently symmetrical forms (47/122—38%), and those which are curved either left (35/122—29%) or right (40/122—33%). The basal cavity has two apices near the posterior end which appear to correspond to the two enlarged denticles observed in some specimens. One specimen appeared to have more than two cavity tips.

Remarks: Juvenile forms and small adult specimens show a tendency for the cusp to be double, each cusp located over a subpit of the basal cavity. With growth the anterior cusp becomes reduced and may be incorporated into the posterior cusp to form a single large posterior denticle. The subpits of the basal cavity tend to become less distinct. Also the cusp changes from being erect and laterally compressed, to posteriorly inclined and oval to round in cross-section.

We have compared our material with 36 specimens of *Pelekygnathus communis* from the Maple Mill Shale of Iowa. The two groups are best distinguished by the number of denticles (see above), but the posterior denticles of all of the Maple Mill species are laterally compressed, posteriorly inclined, and without ridges on the posterior margin.

Figured specimens: CPC 15816 (locality/sample WCB 010/26), 15817 (WCB 010/26), 15818 (WCB 001/9), 15819 (WCB 219/5), 15820 (WCB 010/26) holotype, 15821 (WCB 010/16), 15822 (WCB 010/9).

S₂ element

Pl. 1, fig. 8; Pl. 2, figs. 1-5

1968 *Drepanodina lachrymosa* Mound, p. 480, pl. 65, figs. 49, 50, 55.

Material studied: 121 specimens.

Description: Based on 113 specimens the following observations are made: using the same orientation as Mound, with the narrow margin anterior and the groove or furrow on the inner lateral face, 70 specimens are judged to be left elements and 43 specimens right elements. We consider these cone elements to be asymmetrically paired. Eleven of our specimens are smooth with no indication of striae or ridges on the surface; 102 specimens have some striae and may be further characterised as 51 specimens having a few striae and 51 specimens having numerous striae. The specimens with few striae tend to have larger or more strongly developed striae, which are concentrated on the rounded posterior face. In those specimens with numerous striae, the striae are progressively less prominent as the number increases, and distribution tends to become more uniform on the posterior and lateral surfaces. The anterior margin on 49 specimens tapers to a point and on 47 specimens is foreshortened by an abrupt downturn near the base. The cross-section of the upper part of the cone is rounded to oval in 83 specimens and is distinctly laterally compressed in 23 specimens. None of these characters appear to be inter-related and none are regarded as being of specific or subspecific value.

Remarks: With the exception of the specimens which have well developed striations our material is similar to that described by Mound. The gross aboral surface morphology and the ribbed or striate surface are similar to that observed in the I element.

Figured specimens: CPC 15823 (WCB 205/2), 15824 (WCB 010/26), 15825 (WCB 206/8), 15826 (WCB 010/26), 15827 (WCB 010/13), 15828 (WCB 010/26).

M_{2a} element

Pl. 2, figs. 6-11

1968 *Oneotodus circularis* Mound (part), p. 496, pl. 67, fig. 25 only.

Material studied: 98 specimens.

Description: Erect to suberect cone with circular to near-circular base. This form seems to have a high degree of morphologic variability. The base may be either constricted or flared. If the margin is flared the outer edge tends to be very thin. The axial line of the upper part of the cone is usually not perpendicular to the plane of the cone base. The flexure is usually at a point one-quarter of the total cone height above the base and corresponds to the limit of the excavated portion of the basal cavity. The upper part of the cone is round or nearly round in cross-section. The outer surface may be smooth but usually has well developed striations; as a general rule the greater the number of striations the finer they are. The upper part of the cone contains white matter.

Remarks: This element is equivalent to the M₂ element of the type 4 apparatus of Klapper & Philip (1972, p. 101). Among Mound's photographs (1968, pl. 67), only figure 25 has a distinctly rounded base; the other specimens appear to have some lateral compression of the base and probably should be assigned to an M_{2b} element.

Figured specimens: CPC 15829 (WCB 002/1), 15830 (WCB 202/6), 15831 (WCB 218/1), 15832 (WCB 202/6), 15833 (WCB 002/1), 15834 (WCB 218/1).

M_{2b} element

Pl. 2, figs. 12, 13; Pl. 3, figs. 1-4

Material studied: 136 specimens.

Description: Simple cone with laterally compressed base and rounded upper portion. All specimens assigned to this form are characterised by a laterally compressed basal cavity, but other morphologic features are variable. The plane formed by the edge of the base of the cone ranges from nearly perpendicular to the long axis of the cone to nearly parallel to the axis; the latter form is the more abundant. Viewed laterally, the basal attachment margin may appear either straight or convex. Some specimens show considerable flaring of the margin of the basal cavity, but most are only slightly flared. Excavation of the basal cavity extends a short way along the axis, usually as far as the point of curvature of the axis. The outer surface of most forms is striated, but a few specimens are smooth. The number of striations appears to decrease toward the cone tip, and some twisting of striations around the axis has been noticed. The striations usually do not extend to the basal margin, or if there present are very weak, giving most specimens the appearance of a distinct non-striate margin around the base. The upper part of the cone contains white matter.

Remarks: Our material is very similar to the specimens illustrated as *Oneotodus circularis* by Mound (1968, pl. 67, figs. 26, 31, 35 only). However, we are not sure from the photographs if the bases are round or laterally compressed.

Figured specimens: CPC 15835 (WCB 010/26), 15836 (WCB 010/17), 15837 (WCB 201/12), 15838 (WCB 010/26), 15839 (WCB 001/9), 15840 (WCB 205/2).

APPARATUS A

Diagnosis: Type 3 apparatus of Klapper & Philip. Elements recognised are Pb, N, Sa, Sb, Sc in the nomenclature of Sweet & Schönlaub (1975).

	Pb	N	Sa	Sc	Sb
Pb	-	1	1	1	1
N	1	-	2	5	3
Sa	1	2	-	3	4
Sc	1	5	3	-	4
Sb	1	3	4	4	-

(a)

No. of elements in sample (x)	No. of samples with x elements
5	0
4	2
3	4
2	1
1	7

(b)

Fig. 15. Abundance and grouping of the different elements of the Apparatus A animal.
a—Number of mutual occurrences of each element with other elements.
b—Number of samples in which one or more of the elements occur.

Remarks: Recognition of this apparatus is based on similarity of morphologic features and stratigraphic range. With the exception of the Pb element the apparatus was first isolated on the similarity of cross-sectional shape of the main cusp. Other group similarities are the small basal cavity and the prominent development of what are probably attachment ridges on the aboral or lower lateral margin.

In all only 48 individual elements have been found. The relationships of element abundances are shown in Figure 15.

Range: Apparatus A Assemblage Zone.

Pb element Pl. 3, figs. 5, 6

Material studied: 2 specimens.

Description: Arched blade form with slightly everted basal attachment area and a posteriorly curved subcentrally located cusp. Both anterior and posterior tips of the blade are slightly downturned, accentuating the arched appearance. There are six or seven anterior denticles and seven posterior denticles in the complete specimen. All denticles are closely appressed and laterally compressed. One specimen shows a slight gap between the cusp and the anterior denticles. Aborally the form narrows to a ridge that extends along most of the length. This surface has attachment ridges along its length. The basal cavity is located under the cusp and projects down slightly. The cavity is small and elongate. Too few specimens were observed to indicate the range of variability of morphologic features.

Figured specimens: CPC 15841 (WCB 104/38), 15842 (WCB 104/30).

N element Pl. 3, figs. 7-9

Material studied: 8 specimens.

Description: The N element consists of a prominent major cusp with a short, downwardly directed, anterior process supporting up to 7 denticles and a long posterior process, also downwardly directed, supporting 13 to 16 denticles. The denticles are rounded to slightly flattened along the axis of the bar. They are appressed where they erupt from the bar, and become free-standing and pointed toward their tips. Some specimens show both cap fusion and denticle suppression, but this is limited to a few denticles near the cusp. Denticle white matter is visible within the bar to near its base.

The posterior bar has a broad, flattened aboral surface, rounded margins, and in mature specimens a broad upper surface from which the denticles erupt

near the centre line. The anterior bar is much narrower or blade-like.

The basal cavity is at the junction of the bars and below the cusp. It is directed toward the inner-lateral face and is triangular to semiround with the lower edge straight.

Figured specimens: CPC 15843 (WCB 012/2), 15844 (WCB 012/2), 15845 (WCB 013/39).

Sa element

Pl. 4, figs. 7-9

1969 *Hibbardella* (*Hibbardella*) cf. *H. plana* Thomas; Druce, p. 65, pl. 9, figs. 1-3.

Material studied: 16 specimens.

Description: The Sa element consists of a prominent major cusp flanked laterally by two symmetrical processes and a denticulate posterior process. The cusp is the largest denticle, and is rounded anteriorly with flange-like margins and a rounded to sharp ridge on the posterior margin. The flanges show only on the posterior face.

The lateral processes are outwardly directed and then sharply downturned near the end. Denticles on these processes are erect, with biconvex cross-section and sharp edges. Denticles may be closely appressed at the base but are free-standing for most of their height. The denticles adjacent to the cusp are smaller. The size of the denticles increases to the second or third denticle from the cusp, which may be almost equal in size to the cusp, and then decreases rapidly along the downward projection. The lateral processes are thickened in adult specimens. The anterior face usually shows raised, thickened ridges near the aboral margin.

The posterior process is fragile and usually broken, but two specimens (Pl. 4, figs. 8, 9) that have complete or nearly complete processes have nine and ten denticles preserved. The denticles are short and subrounded. The process is about one-quarter to one-half the height of the lateral processes and joins the lateral processes at the base of the cusp and well above the aboral margin.

The basal cavity is very reduced and is seen only as a very narrow slit at the juncture of the processes.

Figured specimens: CPC 15854 (WCB 012/2), 15855 (WCB 012/2), 15856 (WCB 012/2).

Sc element

Pl. 3, figs. 10, 11; Pl. 4, figs. 1, 2

1969 *Falcodus tortus* Huddle; Druce, p. 57, pl. 8, figs. 1-3.

Material studied: 11 specimens.

Description: Ligonodiniform element with a prominent anterior inner-lateral process, aborally directed. The cusp is slightly recurved with a sharp anterior margin and rounded posterior margin. The anterior inner-lateral process is sharply downturned and supports five to eight discrete denticles. The posterior bar is laterally expanded along the oral margin and narrows aborally. Posterior to the cusp are four to six small denticles followed by one, or sometimes two, enlarged denticles. Posterior to the enlarged denticle the bar is aborally deflected and supports another three or four denticles. All denticles are discrete at their tips and are slightly laterally compressed. The basal pit is very small and is located under the cusp. A shallow groove may extend along the aboral surface posteriorly from the basal cavity.

Figured specimens: CPC 15846 (WCB 012/2), 15847 (WCB 012/2), 15848 (WCB 013/39), 15849 (WCB 013/20).

Sb element
Pl. 4, figs. 3-6

1969 *Falcodus veeversi* Druce, p. 59, p. 8, figs. 6, 7, text-fig. 15.

Material studied: 11 specimens.

Description: Strongly arched bar with a prominent cusp. The cusp is usually located slightly anterior to mid-length of the bar. The anterior portion of the bar supports six to eight denticles which decrease in size toward the tip. The posterior portion of the bar supports eight to ten denticles. Posterior to the cusp are two or three small denticles, followed by one to three large denticles, then reduction of denticle size to the bar tip. The posterior bar flexes downward under the enlarged denticles. All denticles are discrete and laterally compressed. The large denticles have a distal flange with an outer rounded surface. The bar itself is wider than the denticles at the upper surface but narrows to a knife edge at the lower surface. The basal cavity is small and located under the cusp.

Figured specimens: CPC 15850 (WCB 012/2), 15851 (WCB 012/3), 15852 (WCB 104/45), 15853 (WCB 012/3).

DISCRETE ELEMENT TAXONOMY

Genus *Acodina* Stauffer, 1940

Type species: *Acodina lanceolata* Stauffer, 1940.

***Acodina* sp. A**
Pl. 5, figs. 1-4

Material studied: 12 specimens.

Description: Simple cone form with distal tip bent inward and slightly toward the posterior. The basal cross-section is lachrymiform with the narrow tip posterior and a broadly rounded anterior margin. At mid-height the cross-sectional shape is ovate with sharp anterior and posterior margins. The outer face is nearly flat except near the anterior and posterior margins. Variation of width results from curvature of the inner face. From just above mid-height the specimen is bent inward and slightly towards the anterior. Twisting of the upper part of the cone is noted in some specimens. The basal cavity is laterally asymmetrical with the deepest point near the posterior margin. The walls of the cavity flare downward toward the anterior margin. The cavity is excavated to between one-quarter and one-third the total height of the specimen.

Remarks: Morphologically our material is similar to *Drepanodina lachrymosa* but is not placed in that genus because it also appears to come within the generic definition of *Acodina* (Stauffer, 1940, p. 418). As all of these cone elements should probably be placed in apparatus species and because of the need to examine Stauffer's types, we have not tried to resolve the problem of the generic assignment of this material.

Figured specimens: CPC 15857 (WCB 001/9), 15858 (WCB 001/9), 15859 (WCB 202/7), 15860 (WCB 202/25).

Range: Within the *Icriodus platys* A.Z.

***Acodina* sp. B**
Pl. 5, figs. 5, 6

Material studied: 2 specimens.

Description: Simple cone with slightly lachrymiform base and a laterally compressed upper portion. The basal cross-section is lachrymiform with a sharp posterior margin and rounded anterior margin. The outer face is convex and the inner face has a concave anterior portion and a convex posterior portion. A broad shallow groove is formed near the base of the inner face by this flexure but becomes indistinct toward the tip. Above the base both anterior and posterior margins are sharp. The cone is laterally compressed, being about three or four times longer than it is wide. The greatest length is just above the base and the greatest thickness is in the posterior third. The basal cavity is deepest near mid-length and the tip of the cavity is directed toward the anterior margin. The upper part of the cone contains white matter. The anterior margin of the cone slopes slightly toward the posterior, and the posterior margin is nearly vertical.

Remarks: The same remarks made for *Acodina* sp. A apply to *A. sp. B*. In addition, with only two specimens we cannot give the range of variability of the species.

Figured specimens: CPC 15861 (001/17), 15862 (201/11).

Range: Within the *Icriodus platys* A.Z.

Genus *Anchignathodus* Sweet, 1970

Type species: *Anchignathodus typicalus* Sweet, 1970.

***Anchignathodus cristulus* (Youngquist & Miller, 1949)**
Pl. 5, figs. 7-12

1949 *Spathognathodus cristula* Youngquist & Miller, p. 621, pl. 101, figs. 1-3; Merrill, 1973, p. 304, pl. 3, fig. 62 (with synonymy).

1970 *Anchignathodus cristulus* (Youngquist & Miller); Sweet, p. 222.

Material studied: 22 specimens.

Description: Spathognathodiform element, laterally compressed, usually with prominent enlarged anterior denticle(s) and slightly downturned posterior margin. The material studied shows considerable variation.

Spathognathodiform element with one or two enlarged anterior denticles. Eight (21) of the specimens have two equally enlarged anterior denticles and 16 (19) specimens have a second denticle that is significantly larger than the third denticle. The anterior margin is nondenticulate and the anterior-most denticle is distinctly triangular in lateral view. The posterior denticles are shorter and more axially elongate than denticles over the basal cavity and are fused to near their apices. About a quarter of the specimens show either apical fusion or denticle suppression. The posterior end may be slightly downturned. The basal cavity is usually elongate, rounded anteriorly and narrows to a point at

its posterior margin. The cavity does not extend to either the anterior or posterior margin.

Remarks: Sweet (1970) established the genus *Anchignathodus* as a single-element-type apparatus and traced its phylogeny back to its derivation from spathognathodid stock with *A. (S.) regularis* (Branson & Mehl, 1938) as the oldest form assigned to the new genus. Later Sweet (1973) restricted his interpretation of *Anchignathodus* to only those single-element-type apparatuses such as *A. typicalis* and *A. minutus*.

We feel that it is improbable that there was a sudden loss of element types from the *Spathognathodus* (*Ozarkodina*)/*Anchignathodus* apparatus, but rather that the reduction from the 6 elements of the *Ozarkodina*-type apparatus to the single-element-type apparatus of *A. typicalis* was by a process of progressive reduction of element types. For this reason we think it wrong to restrict the generic concept of *Anchignathodus* to the single-element-type apparatus. Rather our concept of the genus is that the phylogeny of the Pa element, on which the genus was based, should be used as the prime basis in defining the genus and the trend toward fewer elements noted as a trend within the genus. Both Sweet (1970) and Merrill (1973) acknowledge the basic validity of the phylogeny of the genus from *A. cristulus* to *A. minutus*. The 22 specimens from this study are too few to allow the full variation of this species at this stage in its evolution to be determined. It is apparent that later in the Carboniferous the species stabilised its morphology. At this early stage in its evolution *A. cristulus* appears to retain a tendency to dual primary denticles and this demonstrates its probable ancestral relationship to the genus *Spathognathodus* and probably to forms like *S. regularis*. This appears to be the earliest recorded occurrence of *A. cristulus*.

Figured specimens: CPC 15863 (WCB 013/20), 15864 (WCB 012/2), 15865 (WCB 104/25), 15866 (WCB 101/23), 15867 (WCB 103/63), 15868 (WCB 012/2).

Range: Latest *Clydagnathus gilwernensis* A.Z. to *Bispathodus spinulicostatus* A.Z.

Genus *Angulodus* Huddle, 1934

Type species: *Angulodus walrathi* (Hibbard, 1927).

Angulodus compressa (Huddle, 1934)

Pl. 5, figs. 13-15

1934 *Hindeodella compressa* Huddle, p. 41, pl. 5, fig. 4.

1969 *Hindeodella compressa* Huddle; Druce, p. 68, pl. 9, figs. 8, 9.

Material studied: 85 specimens.

Remarks: *Angulodus compressa* differs from the generic conception of *Angulodus* in that the posterior bar is not downturned. However, the anterior process and the nature of the cusp are nearly identical with *A. pergracilis*. We feel that the general nature of the form is closer to the concept of *Angulodus* than *Hindeodella*.

Figured specimens: CPC 15869 (WCB 017/20), 15870 (WCB 201/9), 15871 (WCB 007/23).

Range: Unnamed zone ('birdseye limestone') to *Bispathodus spinulicostatus* A.Z.

Angulodus pergracilis (Ulrich & Bassler, 1926)

Pl. 6, figs. 1-5

1926 *Bryantodus pergracilis* Ulrich & Bassler, 1926, p. 27, pl. 10, fig. 11.

1949 *Centrognathus dubius* Thomas, 1949, p. 419, pl. 4, fig. 3.

1968 *Angulodus pergracilis* (Ulrich & Bassler); Huddle, 1968, p. 8, pl. 2, figs. 1, 2.

Material studied: 29 specimens.

Remarks: We have allowed a fair range of morphologic variability in the specimens that we have included in *A. pergracilis*. Most of the variability is related to the shape of the posterior end, especially the extent of the aboral deflection. It is possible that *Angulodus walrathi* (Hibbard) and *A. demissus* Huddle should also be included in this species.

Figured specimens: CPC 15872 (WCB 007/27), 15873 (WCB 218/5), 15874 (WCB 007/26), 15875 (WCB 019/2), 15876 (WCB 007/40).

Range: *Polygnathus communis collinsoni* A.Z. to *Bispathodus spinulicostatus* A.Z.

Genus *Apatognathus* Branson & Mehl, 1934

Type species: *Apatognathus varians* Branson & Mehl, 1934.

Apatognathus sp.

Material studied: 2 specimens.

Remarks: Two specimens were recovered that are assigned to the genus *Apatognathus*. The specimens are poorly preserved and we have neither illustrated them nor assigned them to a species.

Range: Within the *Icriodus platys* A.Z.

Genus *Bispathodus* (Müller, 1962)

Type species: *Spathodus spinulicostatus* E. R. Branson.

Bispathodus aculeatus aculeatus (Branson & Mehl, 1934)

Pl. 22, figs. 6, 7

1934 *Spathodus aculeatus* Branson & Mehl, p. 186, pl. 17, figs. 11, 14.

1973 *Spathognathodus aculeatus* (Branson & Mehl); Matthews & Naylor, p. 368, pl. 35, figs. 3-9.

1974 *Bispathodus aculeatus aculeatus* (Branson & Mehl); Ziegler & others, p. 101, pl. 1, fig. 5; pl. 2, figs. 1-8 (with synonymy).

Material studied: 41 specimens.

Remarks: Our material conforms to the generally accepted range of variation of *B. aculeatus aculeatus* as illustrated by Ziegler & others (1974) and Klapper (1966). *B. aculeatus aculeatus* is distinguished from *B. aculeatus plumulus* by the character of the blade.

Figured specimens: CPC 16016 (WCB 103/63), 16017 (WCB 103/23).

Range: Apparatus A Assembly Zone to *Bispathodus spinulicostatus* A.Z.

Bispathodus aculeatus plumulus (Rhodes, Austin & Druce, 1969)

Pl. 24, figs. 1-6

1966 *Spathognathodus aculeatus* (Branson & Mehl); Glenister & Klapper, p. 835, pl. 95, fig. 11.

1969 *Spathognathodus plumulus plumulus* Rhodes, Austin & Druce, p. 229, pl. 1, figs. 1, 2, 5, 6.

1969 *Spathognathodus plumulus plumulus* Rhodes, Austin & Druce, p. 130, pl. 30, figs. 6, 7.

1969 *Spathognathodus plumulus nodosus* Rhodes, Austin & Druce, p. 230, pl. 1, figs. 3, 4.

1969 *Spathognathodus plumulus nodosus* Rhodes, Austin & Druce, p. 131, pl. 30, figs. 3, 4.

1969 *Spathognathodus plumulus shirleyae* Rhodes, Austin & Druce, p. 230, pl. 1, figs. 7, 8.

1969 *Spathognathodus plumulus shirleyae* Rhodes, Austin & Druce, p. 132, pl. 30, fig. 5.

1969 *Spathognathodus sculderus* Druce, p. 135, pl. 43, figs. 1-5.

1973 *Spathognathodus plumulus plumulus* Rhodes, Austin & Druce; Austin & Hill, p. 128, pl. 1, figs. 3-6, 18-21.

1973 *Spathognathodus plumulus nodosus* Rhodes, Austin & Druce; Austin & Hill, p. 128, pl. 1, figs. 7, 8, 22, 23.

- 1973 *Spathognathodus plumulus shirleyae* Rhodes, Austin & Druce; Austin & Hill, p. 128, pl. 1, figs. 2, 17.
 1974 *Bispathodus aculeatus plumulus* (Rhodes, Austin & Druce, 1969); Ziegler & others, p. 101, pl. 2, figs. 10, 11; pl. 3, fig. 24 (with synonymy).

Material studied: 132 specimens.

Remarks: In this study we were unable to make a clear distinction between forms previously assigned to *S. plumulus* and *S. sculderus*. Druce (1969) distinguished *S. sculderus* on the basis of a thickening of the left margin of the posterior blade denticle that continues posteriorly to merge with the line of lateral nodes. Material from this study shows a complete gradation from specimens with very distinct lateral thickening through specimens with only slight thickening to specimens with no thickening. From our study there appears to be no distinction that can be based on stratigraphic range, as was noted by Druce in the Bonaparte Gulf. We thus feel that the character of lateral thickening is not significant enough to be used in distinguishing these specimens, and have placed *S. sculderus* in synonymy with *B. aculeatus plumulus*.

We also do not recognise the subspecies of *S. plumulus* established by Rhodes, Austin & Druce (1969). *S. plumulus shirleyae* as illustrated by Rhodes et al. appears to be based on juvenile forms or a specimen that had developed only one lateral denticle. As the number of denticles of *S. plumulus plumulus* ranges from 3 to 7 (Druce, 1969, p. 131) some specimens would be expected to develop only a single denticle and be within the normal range of variation of the species.

A paratype of *S. plumulus plumulus* (Rhodes, Austin & Druce, 1969, pl. 1, fig. 2) has an enlarged right basal cavity flare with a hint of node. We currently believe that with the rare occurrence of nodose specimens, the addition of the node is not a feature of taxonomic value in Early Carboniferous spathognathodids.

Figured specimens: CPC 16027 (WCB 007/4), 16028 (WCB 007/4), 16029 (WCB 007/15), 16030 (WCB 007/3), 16031 (WCB 007/41), 16032 (WCB 007/1).

Range: *Clydagnathus gilwernensis* A.Z. to early *Bispathodus spinulicostatus* A.Z.

***Bispathodus spinulicostatus* (E. R. Branson, 1934)** Pl. 26, figs. 1-5

- 1934 *Spathodus spinulicostatus* Branson, p. 305, pl. 27, fig. 19.
 1934 *Spathodus sulciferus* Branson & Mehl, p. 274, pl. 22, fig. 13.
 1934 *Spathodus sulciferus* Branson & Mehl; Branson, p. 304, pl. 27, fig. 20 only.
 1969 *Spathognathodus costatus sulciferus* (Branson & Mehl); Rhodes, Austin & Druce, p. 226, pl. 3, figs. 16, 17 only.
 1969 *Spathognathodus costatus sulciferus* (Branson & Mehl); Druce, p. 127, pl. 29, figs. 6-8.
 1974 *Bispathodus spinulicostatus* (E. R. Branson, 1934); Ziegler & others, pl. 1, figs. 6-8; pl. 3, figs. 20, 22 (with synonymy).

Material studied: 15 specimens.

Remarks: Our material is similar to that described by Ziegler & others (1974).

Figured specimens: CPC 16039 (WCB 103/53), 16040 (WCB 103/23), 16041 (WCB 103/23), 16042 (WCB 103/53), 16043 (WCB 103/1).

Range: Within the *Bispathodus spinulicostatus* A.Z.

***Bispathodus ziegleri* (Rhodes, Austin & Druce, 1969)** Pl. 26, fig. 6

- 1969 *Spathognathodus ziegleri* Rhodes, Austin & Druce, p. 238, pl. 4, figs. 5-8.
 1974 *Bispathodus ziegleri* (Rhodes, Austin & Druce, 1969); Ziegler & others, pl. 2, fig. 16.

Material studied: one specimen.

Remarks: The single specimen from this study is similar in all respects to the material illustrated by Rhodes, Austin & Druce.

Figured specimen: CPC 16044 (WCB 002/1).

Range: within the *Icriodus platys* A.Z.

Genus *Clydagnathus* Rhodes, Austin & Druce, 1969 *Type species:* *Clydagnathus cavusformis* Rhodes, Austin, & Druce, 1969.

Morphologic distinction of *Clydagnathus* and *Cavusgnathus* is difficult, but necessary for biostratigraphic purposes. Rhodes, Austin & Druce (1969, p. 85), distinguished *Clydagnathus* from *Cavusgnathus* 'by the general anterior closure of the oral trough, by the merging of the marginal ornament with the blade, and by the lateral, rather than longitudinal, expansion of the cavity'. Detailed examination of over 250 specimens that we assign to *Clydagnathus* from the type Laurel Formation sections (WCB 101, WCB 102, WCB 103) demonstrates that the above criteria cannot be used for distinguishing the genera. Of the specimens from the type Laurel Formation, 237 have been assigned to *Clydagnathus cavusformis*. This includes forms that Rhodes, Austin & Druce (1969) would have assigned as *Cl. unicornis* and *Cl. darensis*. Over half of the 237 specimens have a significant space between the parapet and the blade. In addition, more than half of the specimens show some modification of the nodes of the anterior end of the left parapet. The basal cavity outline does tend to be more expanded laterally than for most other species of *Cavusgnathus* but no more so than the cavity of *Cavusgnathus naviculus*.

We suggest that the following criteria are useful in distinguishing *Clydagnathus* from *Cavusgnathus*. Denticle counts on left and right parapet (mean values 6.6 and 8.7 respectively for *Cl. cavusformis*) show fewer nodes (denticles) for species of *Clydagnathus* than *Cavusgnathus*. Parapet nodes of *Clydagnathus* also tend to be larger and more distinct than those of *Cavusgnathus*. Except for *Ca. naviculus*, or specimens with transverse ridges on the parapets, the left parapet of *Cavusgnathus* is better separated from the blade and narrower than that of *Clydagnathus*. Discrete denticles are frequently observable in the trough of the platform of *Clydagnathus* but not in *Cavusgnathus*.

In this study we are able to recognise two species of *Clydagnathus*: *Cl. cavusformis*, and *Cl. gilwernensis*. *Cavusgnathus unicornis* from the Bonaparte Gulf Basin is referred to *Cl. cavusformis*.

***Clydagnathus cavusformis* Rhodes, Austin & Druce, 1969** Pl. 6, figs. 7, 9; Pl. 7, figs. 1-3

- 1969 *Clydagnathus cavusformis* Rhodes, Austin & Druce, p. 85, pl. 1, figs. 9-13.
 1969 *Clydagnathus cavusformis* Rhodes, Austin & Druce; Druce p. 50, pl. 4, figs. 1, 5-7.
 1969 *Clydagnathus darensis* Rhodes, Austin & Druce, p. 86, pl. 2, figs. 6, 7.
 1969 *Clydagnathus darensis* Rhodes, Austin & Druce; Druce, p. 50, pl. 4, figs. 8, 9.

1969 *Cavusgnathus unicornis* Rhodes, Austin & Druce, p. 88, pl. 2, figs. 2, 3, 5.

1969 *Clydagnathus nodosus* Druce, p. 52, figs. 1, 2, text-fig. 13.

Material studied: 723 specimens.

Diagnosis: Asymmetrical platform type with anterior blade centred or attached to right parapet. The left parapet in mature specimens is separated from the right parapet by a trough but in early growth stages may be attached to the blade. Posterior blade variable in development. Lips of basal cavity asymmetrical, left margin usually larger than right. Left and right forms exist.

Description: The anterior blade bears from one to seven denticles (mean 3.5). Most specimens, from the detailed study of 250 specimens, show a gradual increase in the size of denticles toward the posterior although a few have the highest denticle at mid-length of the blade. In slightly more than half the specimens the posterior edge of the blade slopes posteriorly; in the remaining specimens it is vertical. Comparison of mature and juvenile specimens indicates that blade growth is toward the anterior with juvenile forms usually possessing only one or two denticles.

The platform consists of two subparallel denticle rows, separated by a shallow trough. The blade appears either in a central position or as a continuation of the right parapet. Juvenile specimens tend to have both parapets attached to the posterior edge of the blade, with the blade in a subcentral position. As the size of specimen increases the left parapet grows anteriorly parallel to the blade, first indicated by a thickening of material and then by node development. Anterior development of the left parapet normally is limited to three or four nodes. The anteriormost node in mature specimens is larger than other left parapet nodes, usually separated by a slight depression in the upper parapet margin from the adjacent nodes and distinctly separated from the blade by a trough. This terminal node is distinctly triangular in shape and is dissimilar to other parapet nodes or denticles. In specimens (especially juvenile forms) lacking this differentiated anterior denticle the left parapet is usually attached to the blade.

The right parapet is usually a continuation of the line of the blade or is very slightly offset outwards from the blade line. In about 20% of the specimens there is denticle development along the right margin of the blade, anterior to the posterior blade margin.

The right parapet is composed of from 4 to 14 nodes (mean 6.6) and the left parapet of from 5 to 16 (mean 8.8). In some cases nodes of the left, right, or parts of both of the parapets are fused and individual nodes cannot be distinguished. In stratigraphically older specimens the nodes of the right parapet tend to be larger than those of the left parapet. Stratigraphically younger specimens have subequal to equal sized nodes.

The posterior blade is composed of from 2 to 9 denticles (mean 4.1) of which usually half extend beyond the lateral parapets. The denticle row of the posterior blade continues down the trough in a subcentral position or slightly toward the left parapet margin.

In lateral view the specimens show variation in the arching. Using the upper surface of the platform as reference, about one-eighth of the specimens show no arching at all. About a quarter of the specimens are strongly arched with the oral surface of the posterior portion of the platform very sharply downturned. The

rest of the specimens are slightly arched. The anterior aboral margin of the blade is sharply upturned in about a quarter of the specimens.

The basal cavity is roughly symmetrical in juvenile specimens, but in mature forms the right flange is reduced relative to the left and the base is markedly asymmetrical. In more than half the specimens the apex of the basal cavity is under the platform but the cavity extends forward under the blade. About a quarter of the specimens show the cavity not extending under the blade. Three specimens show node development on the left flange of the basal cavity.

Remarks: Some specimens, especially juveniles of *Clydagnathus cavusformis*, show evidence of spathognathodid ancestry. Translucent forms show a continuous denticle row of even, regularly spaced denticles along the central axis, similar to such forms as *Bispathodus aculeatus plumulus*. Right parapet denticles appear to develop irregularly, first forming over the basal cavity, and are probably not derived from denticles of the axial row. Left parapet denticles appear to derive from the main central denticle row by deflection of growth. This growth pattern of the left parapet away from the axis to the left tends to emphasise the relationship of the blade with the right parapet.

C. cavusformis appears to have developed from *C. gilwernensis* by the addition of left and right parapet denticles and by extension of the left parapet in an anterior direction along the left side of the anterior blade.

Figured specimens: CPC 15879 (LR 2/10), 15880 (WCB 006/9), 15881 (WCB 007/30), 15882 (WCB 007/41), 15883 (WCB 007/30).

Range: *Clydagnathus gilwernensis* A.Z. to *Bispathodus spinulicostatus* A.Z.

***Clydagnathus gilwernensis* Rhodes, Austin & Druce, 1969**

Pl. 6, figs. 6, 8

1969 *Clydagnathus gilwernensis* Rhodes, Austin & Druce, p. 87, pl. 2, figs. 1a-d.

1969 *Clydagnathus gilwernensis* Rhodes, Austin & Druce; Druce, p. 51, pl. 4, figs. 2-4; pl. 30, fig. 8.

Material studied: 58 specimens.

Remarks: The anterior blade of *C. gilwernensis* is similar to the blade of *Bispathodus aculeatus plumulus*, but is slightly offset to the right in most specimens. Two to six denticles (mean 4.4) develop on the right margin above the basal cavity of the element and form a parapet in mature specimens. The line of the blade clearly continues as the denticle row of the right parapet, but individual denticles become suppressed. Either or both of the parapets may join with the posterior margin of the blade. The blade frequently gives the impression of being centred between the parapets. The deepest part of the trough occurs just behind the blade. The posterior extension of the left parapet, that portion not paralleled by a right parapet, i.e. the posterior blade, may be well developed in more mature specimens. This posterior projection may consist of four or more denticles (mean 5.9).

Figured specimens: CPC 15877 (LR 2/10), 15878 (WCB 007/3).

Range: *Clydagnathus gilwernensis* A.Z. to *Bispathodus spinulicostatus* A.Z.

Genus *Dinodus* Cooper, 1939

Type species: *Dinodus leptus* Cooper, 1939.

Dinodus sp.

Pl. 7, fig. 4

Material studied: 1 specimen.

Remarks: The single specimen of this rare form is broken and neither the length of the processes nor the denticulation can be discerned.

Figured specimen: CPC 15884 (WCB 012/2).

Range: Within the Apparatus A Assemblage Zone.

Genus *Gnathodus* Pander, 1856

Type species: *Gnathodus mosquensis* Pander, 1856.

Gnathodus sp.

Pl. 7, fig. 5

Material studied: 1 specimen.

Remarks: This single specimen of *Gnathodus* is juvenile and could be assigned to any of several species or possibly to *Protognathodus*.

Figured specimen: CPC 15885 (WCB 103/1).

Range: Lower *Bispathodus spinulicostatus* A.Z.

Genus *Hibbardella* Bassler, 1925

Type species: *Prioniodus angulatus* Hinde, 1879.

Five species of *Hibbardella* are differentiated in this study and a fairly broad range of morphologic variation has been allowed. There appears to be some intergradation between some of the species recognised. Preservation is poor and most of the specimens are fragmentary.

Most of the specimens referred to *Hibbardella* (or *Roundya* and *Trichonodella*) by Cooper (1939), Thomas (1949), Branson & Mehl (1934), E. R. Branson (1934), and others are too poorly preserved or illustrated to serve as the basis for identification of specimens in modern studies, without abundant topotype material and a detailed examination of the type specimens.

Hibbardella brevialeta (Branson & Mehl, 1934)

Pl. 8, fig. 1

1934 *Trichognathus brevialeta* Branson & Mehl, p. 291, pl. 23, fig. 29.

1969 *Hibbardella brevialeta* (Branson & Mehl); Rexroad, 1969, p. 21, pl. 5, figs. 1, 2.

Material studied: 1 specimen.

Remarks: Our single specimen is very close to those illustrated by Rexroad.

Figured specimen: CPC 15886 (WCB 102/10).

Range: Within the *Spathognathodus canningensis* A.Z.

Hibbardella? helmsi new name

Pl. 8, fig. 2

1959 *Roundya plana* Helms (non *Hibbardella plana* Thomas, 1949), p. 654, pl. 6, fig. 26.

1969 *Hibbardella? sp.* Druce, p. 67, pl. 9, fig. 7.

Derivation of name: After Dr J. Helms, who originally described the species.

Material studied: 4 specimens.

Description: An asymmetrical hibbardellid. The anterior lateral processes are not at right angles to the axis of the posterior bar as in most hibbardellids. One process is anteriorly directed, almost along the line of the axis of the posterior process. The second anterior process is laterally or posterior-laterally directed. Both anterior processes bear discrete denticles. The height of the pro-

cesses is variable. The cusp is massive, erect, and slightly recurved posteriorly. The cusp and posterior process are laterally compressed and the cusp is oval in cross-section with a broadly rounded posterior margin and narrow anterior margin. The posterior process of our material is broken but the denticles preserved are discrete and slightly elliptical. Specimens illustrated by Helms (1959) and Druce (1969) have six large denticles increasing in size to beyond mid-length of the process. The basal cavity is distinct and located under the main cusp. It is elongated and extends towards the anteriorly directed lateral process but not toward the posteriorly directed lateral process. A shallow groove extends for some distance along the aboral margin of the posterior process.

Remarks: Druce (1969, p. 67) recognised the similarity of *R. plana* Helms and the single specimen from the Bonaparte Gulf study. With the additional specimens from this study we feel that the material is identical to German material illustrated by Helms (1959, pl. 6, fig. 26). By assigning the material to *Hibbardella* the name *H. plana* Helms becomes a homonym with *H. plana* Thomas, 1949. We believe, despite the asymmetry of the anterior processes, that our material most closely resembles material assigned to *Hibbardella* and represents the symmetrical (Sa) element in an apparatus. Owing to the homonym problem we have established a new name for the species and the holotype is the specimen illustrated by Helms (C213, Berlin).

Figured specimen: CPC 15887 (WCB 002/13).

Range: Within the *Icriodus platys* A.Z.

Hibbardella cf. *H. insignis* Huddle, 1934

Pl. 8, figs. 3-5

1969 *Hibbardella* (*Hibbardella*) cf. *H. macrodentata* Thomas; Druce, p. 64, pl. 9, figs. 4-6.

Material studied: 112 specimens.

Description: The cusp is erect and posteriorly curved, its anterior margin is rounded and the upper portion may be slightly twisted. The lateral processes extend outward and slightly downward from their point of attachment anterior to the cusp. Denticles are widely spaced, round and slightly curved posteriorly. Between the major denticles are gaps which are filled by either non-eruptive or diminutive denticles. The posterior process decreases in height rapidly and has only a few eruptive denticles. Those posterior process denticles that have erupted are small and usually broken. The basal cavity varies in size and extent. Specimens with low lateral process cross-sections appear to have larger basal cavities than those specimens with high lateral process cross-sections. Specimens with very large basal cavities tend to have a groove that extends posteriorly along the aboral surface of the posterior bar.

Remarks: Reference of our material to *H. cf. H. insignis* is based on the morphology of the lateral processes. Our material may be similar to specimens assigned by Thomas (1949, p. 422) to *H. macrodentata*; however, the single broken specimen illustrated by Thomas is not well enough preserved to be diagnostic.

We believe that *H. insignis* should be assigned to *Hibbardella* rather than *Diplododella* as suggested by Huddle (1968, p. 12) because the species appears to have a distinct basal cavity.

Figured specimens: CPC 15888 (WCB 007/23), 15889 (WCB 007/41), 15890 (WCB 202/29).

Range: Throughout sequence *Polygnathus communis collinsoni* A.Z. to *Bispathodus spinulicostatus* A.Z.

Hibbardella cf. *H. micra* (Cooper, 1939)

Pl. 9, figs. 1-3, 5, 6

1939 *Trichognathus micra* Cooper, p. 422, pl. 46, fig. 47.

1969 *Hibbardella* (*Hibbardella*) sp. A Druce, p. 66, pl. 7, figs. 11a, b.

Material studied: 127 specimens.

Description: The cusp is erect, and its upper part is posteriorly curved. The anterior margin of the lower part of the cusp is somewhat flattened. The cross-section of the upper portion of the cusp is subround. The cusp gives the general impression of being laterally compressed and its upper part may be slightly twisted. The lateral processes have a relatively high bar with discrete, round large denticles. Between the large denticles are small or non-eruptive denticles. The lateral processes are directed outward and slightly downward. The terminal tips of these processes may be deflected slightly downward. The posterior process is relatively high, is laterally compressed, and does not appear to diminish in height towards the posterior. This process has numerous small denticles that are broken at or just above the process surface. The terminal portions of all the processes examined were broken. The basal cavity is very small; it is triangular and located at the juncture of the lateral processes.

Remarks: The relationship between our material and that described by Cooper is tenuous. The assignment is based on the small basal cavity and the morphology of the posterior process. *H. cf. H. insignis* is very similar to *H. cf. H. micra*. Distinction between the two species is based on the morphology of the lateral processes and basal cavities.

Figured specimens: CPC 15891 (WCB 017/34), 15892 (WCB 017/34), 15893 (WCB 017/15), 15894 (WCB 010/8), 15896 (WCB 017/34).

Range: *Polygnathus communis collinsoni* A.Z. to *Bispathodus spinulicostatus* A.Z.

***Hibbardella* (*Hibbardella*) sp. nov. Druce, 1969**

Pl. 9, figs. 4, 7

1969 *Hibbardella* (*Hibbardella*) sp. nov. Druce, p. 66, pl. 7, fig. 12.

Material studied: 9 specimens.

Description: A species of *Hibbardella* with small but distinct basal cavity and high lateral processes. The cusp is erect, laterally compressed, and slightly recurved posteriorly. The lateral processes are very high, and project slightly anterior to the cusp. Each supports 4 to 6 major denticles and more numerous minor eruptive or suppressed denticles. The aboral margin of the lateral processes is directed slightly downward and then curves upward near the outer tip. The posterior process is also relatively high and is laterally compressed. In most specimens the posterior process is broken but one specimen (pl. 9, fig. 7) has a very long process. This process is composed of larger denticles usually alternating with two small denticles. The basal cavity is located at the junction of the processes. It is small and triangular with a narrowing groove extending for a short distance along the posterior process.

Remarks: The upward curvature of the outer portion of the lateral process of these specimens serves to distinguish this species from others of this study.

Figured specimens: CPC 15895 (WCB 202/29), 15897 (WCB 202/14).

Range: Within the *Icriodus platys* A.Z.

Genus *Hindeodella* Bassler, 1925

Type species: *Hindeodella subtilis* Bassler, 1925.

***Hindeodella acuta* Branson & Mehl, 1934**

Pl. 10, figs. 1-3

1934 *Hindeodella acuta* Branson & Mehl, p. 196, pl. 14, fig. 8.

1969 *Angulodus flexus* Druce, p. 39, pl. 1, figs. 2, 3, text-fig. 8.

Material studied: 6 specimens.

Remarks: This reasonably distinctive hindeodellid with its short length and in-turned anterior-inner lateral process is rare in our collections. Because much of the hindeodellid material is fragmental the species may be more abundant than our tabulation shows.

Figured specimens: CPC 15898 (WCB 007/19), 15899 (WCB 007/36), 15900 (WCB 017/69).

Range: *Bispathodus spinulicostatus* A.Z.

***Hindeodella brevis* Branson & Mehl, 1934**

Pl. 10, figs. 4-7

1934 *Hindeodella brevis* Branson & Mehl, p. 195, pl. 14, figs. 6, 7.

1969 non *Hindeodella brevis* Branson & Mehl; Druce, p. 67, pl. 10, figs. 1, 2.

1969 *Angulodus minutus* Druce, p. 40, pl. 1, figs. 4-8, text-fig. 9.

Material studied: 28 specimens.

Description: A very short hindeodellaform element with the anterior bar turned inward at right angles. There are 5 to 7 major denticles, usually long and rounded. The cusp is the largest of the denticles and is located slightly anterior to mid-length. There are a few minor denticles between the major denticles.

Remarks: *Hindeodella brevis* is variable, with a tendency to reduce the number of denticles. Some specimens are very similar to *H. acuta* but are shorter. There also appears to be a tendency for the posterior bar to be bent inward.

Figured specimens: CPC 15901 (WCB 007/29), 15902 (WCB 010/6), 15903 (WCB 017/69), 15904 (WCB 201/8).

Range: Throughout the sequence *Polygnathus communis collinsoni* A.Z. to *Bispathodus spinulicostatus* A.Z.

***Hindeodella corpulenta* Branson & Mehl, 1934**

Pl. 10, fig. 8; Pl. 11, figs. 11-13

1934 *Hindeodella corpulenta* Branson & Mehl, 1934, p. 281, pl. 22, figs. 32, 22.

1969 *Hindeodella corpulenta* Branson & Mehl; Druce, p. 68, pl. 10, figs. 5-7.

See Rhodes, Austin & Druce (1969) for synonymy.

Material studied: 117 specimens.

Remarks: *Hindeodella corpulenta* is very similar to *H. longidens* Ulrich & Bassler. The only distinction between the species appears to be the presence of secondary denticles on the posterior bar of *H. corpulenta* that are apparently lacking in *H. longidens*. This distinction may be a function of preservation.

Figured specimens: CPC 15905 (WCB 207/44), 15916 (WCB 010/39), 15917 (WCB 017/16), 15918 (WCB 202/18).

Range: Throughout the sequence *Polygnathus communis collinsoni* A.Z. to *Bispathodus spinulicostatus* A.Z.

***Hindeodella subtilis* Bassler, 1925**

Pl. 11, figs. 5-7

1925 *Hindeodella subtilis* Bassler, p. 219.

1926 *Hindeodella subtilis* Bassler; Ulrich & Bassler, p. 39, pl. 8, figs. 17-19, text-fig. 4, No. 3.

1968 *Hindeodella subtilis* Bassler; Huddle, p. 16, pl. 5, figs. 5-7, 8, 10-15 (with synonymy).

Material studied: 118 specimens.

Remarks: Our material agrees closely with the material illustrated by Ulrich & Bassler.

Figured specimens: CPC 15910 (WCB 012/2), 15911 (WCB 014/16), 15912 (WCB 202/3).

Range: Through the sequence unnamed zone ('birdseye limestone') to *Bispathodus spinulicostatus* A.Z.

Hindeodella sp. nov. A

Pl. 11, figs. 8-10

Material studied: 74 specimens.

Description: Hindeodellaform element with long posterior bar and anterior-lateral process directed slightly downward. The cusp is slightly recurved posteriorly along the main axis. The processes are marked by regularly spaced large denticles separated by numerous small denticles. The anterior process is curved inward at an angle of less than 45 degrees. Denticles on this process are reduced, or may be absent near the cusp, but increase in size near the distal end. The basal cavity is reduced, but a distinctive flange may be present on the outer margin at the flexure of the process.

Remarks: This species is apparently closely related to *Hindeodella subtilis*. It differs from *H. subtilis* in the character of the junction of the anterior-lateral process with the cusp. In *H. subtilis* denticulation continues up to the cusp and the process is laterally compressed. In *H. sp. nov. A* this process bears few or no denticles for a short distance adjacent to the cusp. The process is also more rounded than that of *H. subtilis*. This species may grade into *H. subtilis*.

Figured specimens: CPC 15913 (WCB 010/39), 15914 (WCB 010/39), 15915 (WCB 007/45).

Range: Latest *Clydagnathus gilwernensis* A.Z. to *Bispathodus spinulicostatus* A.Z.

Hindeodella sp. nov. B

Pl. 11, figs. 1-4

1969 *Angulodus* sp. B Druce, p. 41, pl. 1, fig. 1a, b.

Material studied: 10 specimens.

Description: A hindeodellaform element with anterior end deflected inward. The cusp is reduced in size, more like an angulodid than a hindeodellid. The basal cavity is very small and not easily observed. The posterior bar end may be slightly downturned. Along the length of the bar large denticles are separated by one to four smaller denticles.

Remarks: Because the genus *Angulodus* is defined on the character of downturned posterior and anterior ends of the bar rather than the character of the cusp this species must be assigned to *Hindeodella*. If, however, the cusp character were used then this species would be most easily linked with *Angulodus*.

Figured specimens: CPC 15906 (WCB 017/50), 15907 (WCB 218/5), 15908 (WCB 010/4), 15909 (WCB 207/44).

Range: *Polygnathus communis collinsoni* A.Z. to *Bispathodus spinulicostatus* A.Z.

Genus Ligonodina Bassler, 1925

Type species: *Ligonodina pectinata* Ulrich & Bassler, 1926.

Ligonodina platys Cooper, 1939

Pl. 12, fig. 6

1939 *Ligonodina platys* Cooper, p. 391 pl. 45, fig. 47.

1939 *Ligonodina delectatula* Branson & Mehl (sic), Cooper (part), p. 390, pl. 45, fig. 50 only.

1969 *Ligonodina platys* Cooper; Rexroad, p. 24, pl. 9, figs. 19, 20.

Material studied: 6 specimens.

Remarks: Our material is very close to that illustrated by Rexroad.

Figured specimen: CPC 15925 (WCB 102/10).

Range: Latest *Spathognathodus canningensis* A.Z. to *Bispathodus spinulicostatus* A.Z.

Genus Neoprioniodus Rhodes & Müller, 1956

Type species: *Prioniodus conjunctus* Gunnell, 1931.

Neoprioniodus cf. **N. alatoideus** (Cooper, 1939)

Pl. 12, figs. 8, 9

1939 *Prioniodus alatoideus* Cooper, p. 404, pl. 45, fig. 62; pl. 46, fig. 19.

Material studied: 6 specimens.

Description: Cusp erect with anterior margin of cusp and anticusp forming a straight line. Posterior process directed slightly downward with discrete but closely spaced denticles.

Remarks: This form may be an extreme variant of forms that we have assigned to *N. alatus*. However, the morphology of the anticusp and the lesser amount of downward deflection of the posterior bar appear to distinguish this species.

Figured specimens: CPC 15926 (WCB 007/30), 15927 (WCB 007/30).

Range: Within the *Spathognathodus canningensis* A.Z.

Neoprioniodus alatus (Hinde, 1879)

Pl. 12, figs. 10-13

1879 *Prioniodus? alatus* Hinde, v. 35, p. 361, p. 16, fig. 5.

1926 *Prioniodus alatus* Hinde; Ulrich & Bassler, 1926, v. 68, art. 12, p. 11, pl. 1, figs. 25, 26;

1933 *Prioniodus alatus* Hinde; Branson & Mehl, v. 8, p. 134, pl. 11, fig. 13.

1934 *Prioniodus molestus* Branson & Mehl, p. 207, pl. 15, fig. 8.

1934 *Prioniodus semiseparatus* Branson & Mehl (part), p. 206, pl. 15, fig. 9 only.

1968 *Neoprioniodus alatus* (Hinde); Huddle p. 25, pl. 6, figs. 1, 2 with synonymy.

1969 *Neoprioniodus confluens* (Branson & Mehl) (part), Rhodes, Austin & Druce, p. 158, pl. 21, fig. 8 only.

1969 *Neoprioniodus confluens* (Branson & Mehl)?; Druce, p. 76, pl. 14, figs. 11, 12.

Material studied: 210 specimens.

Description: Cusp erect with anterior margin straight to anteriorly convex. Anticusp generally short with tip rounded. Posterior bar is straight or slightly curved and is downwardly directed. The angle of deflection of this process from the horizontal plane is variable but usually ranges from 30 to 45 degrees. Denticles are usually appressed and fused to near their tips but may be free-standing. The free-standing denticles tend to be subround in cross-section while most appressed denticles are laterally compressed parallel to the axial plane of the process. Morphology of the flange over the basal cavity is highly variable.

Remarks: The specimens from this study that we have assigned to this species are highly variable in all characters of their morphology. However, no clear divisions of the group can be made with the amount of material in hand. We follow Huddle's interpretation of *N. alatus*, but allow the species a larger posterior process.

Figured specimens: CPC 15928 (WCB 017/69), 15929 (WCB 007/38), 15930 (WCB 103/49), 15931 (WCB 102/10).

Range: Late *Clydagnathus gilwernensis* A.Z. to *Bispathodus spinulicostatus* A.Z.

Neoprioniodus barbatus (Branson & Mehl, 1934)

Pl. 13, figs. 3-5

1934 *Prioniodus barbatus* Branson & Mehl, p. 288, pl. 23, figs. 19, 20.

1969 *Neoprioniodus barbatus* (Branson & Mehl); Rexroad, p. 27, pl. 7, figs. 11-14 (for synonymy).

Material studied: 6 specimens.

Remarks: The distinction between *N. barbatus* and *N. latus* (Bischoff, 1957) is not entirely clear. It is possible that the specimens shown in Pl. 13, figs. 3 and 4 should be retained in *N. barbatus* and Pl. 13, fig. 5 assigned to *N. latus*. However, it is also probable that these two morphologies are intergradational.

Figured specimens: CPC 15934 (WCB 102/6), 15935 (WCB 102/10), 15936 (WCB 102/10).

Range: Within the *Spathognathodus canningensis* A.Z.

Neoprioniodus sp. nov. A

Pl. 13, figs. 1, 2

Material studied: 3 specimens.

Description: The cusp is erect with the anterior margin straight. The antiscusp is short and its anterior margin is shallowly convex. The basal cavity is very small with almost no bulge created by the flange. The posterior process extends downward at about a 75 degree angle from the horizontal plane. Denticles on the process are numerous and fused to near their tips.

Remarks: Our material is somewhat similar to that illustrated by Branson & Mehl (1934, p. 205, pl. 15, figs. 4, 5) as *Prioniodus obtusus*. However, the anterior margin of the antiscusp is more convex in *P. obtusus*.

Figured specimens: CPC 15932 (WCB 007/40), 15933 (WCB 007/40).

Range: Within the *Bispathodus spinulicostatus* A.Z.

Genus Ozarkodina Branson & Mehl, 1933

Type species: *Ozarkodina typica* Branson & Mehl, 1933.

Ozarkodina abnormis Branson & Mehl, 1934

Pl. 13, figs. 6-8

1934 *Ozarkodina abnormis* Branson & Mehl, pp. 193-194, pl. 17, fig. 6.

Material studied: 67 specimens.

Description: An ozarkodinaform element, laterally compressed and usually slightly bowed. This element is characterised by its laterally compressed blade and small basal cavity. The basal cavity is located below or slightly posterior to the cusp. The cavity is slightly elongated along the axis and the aboral margin may be flattened for a short distance posteriorly and anteriorly. The denticles are laterally compressed with sharp edges. The size of the denticles is very irregular and the cusp may be only slightly larger than adjacent denticles. Most specimens show examples of denticle suppression. The anterior bar has 7 to 11 denticles, and the posterior bar 8 to 12 denticles. Mature specimens are slightly arched and laterally bowed.

Remarks: Our material agrees closely with the description given by Branson & Mehl (1934, pp. 193-194), but our specimens have more denticles.

Figured specimens: CPC 15937 (WCB 019/1), 15938 (WCB 207/11), 15939 (WCB 010/4).

Range: Unnamed zone ('birdseye limestone') to *Clydagnathus gilwernensis* A.Z.

Ozarkodina flexa (Branson & Mehl, 1934)

Pl. 13, fig. 9

1934 *Subbryantodus arcuatus* Branson & Mehl, p. 286, pl. 23, figs. 10, 11.

1934 *Subbryantodus flexus* Branson & Mehl, 1934, p. 286, pl. 23, fig. 12.

1955 *Subbryantodus arcuatus* Branson & Mehl; Sanneman, p. 154 pl. 4, fig. 15.

1956 *Ozarkodina arcuata* (Branson & Mehl); Bischoff & Ziegler, pl. 152, pl. 13, fig. 24.

1959 *Ozarkodina homoarcuata* Helms, p. 646, pl. 2, fig. 5.

1964 *Ozarkodina homoarcuata* Helms; Druce, p. 80, pl. 15, figs. 2, 3.

Material studied: 2 specimens.

Figured specimen: CPC 15940 (WCB 007/30).

Range: Late *Clydagnathus gilwernensis* A.Z. to *Spathognathus canningensis* A.Z.

Ozarkodina cf. **O. plana** (Branson & Mehl, 1934)

Pl. 13, figs. 10-13; Pl. 15, figs. 6, 7

1934 cf. *Bryantodus planus* Branson & Mehl, p. 284, pl. 23, fig. 8.

1969 *Ozarkodina plana* (Branson & Mehl); Druce, p. 82, pl. 15, figs. 4a, b.

Material studied: 62 specimens.

Description: An ozarkodinaform element with a posteriorly inclined cusp and irregular denticulation. The blade height is relatively low compared to the length, and the denticles are laterally compressed but not closely appressed. The whole unit is slightly to moderately arched. The cusp is not elongate and is relatively high as compared to the rest of the denticles. The anterior blade has 4 to 6 denticles and the posterior blade 6 to 10 denticles. Adjacent denticles are not of equal size. The basal cavity is relatively large, elongate but narrow, and continues as a narrow groove along the aboral surface.

Remarks: This form appears to add denticles at both anterior and posterior margins as juvenile specimens have fewer denticles than mature forms. Our material is similar to the specimen illustrated by Druce (1969) and referred to *O. plana* (Branson & Mehl). It is also similar to the form *O. radina* (Cooper) illustrated by Rexroad (1969, p. 31), but differs from this form in having fewer denticles. It may be that these two forms are phylogenetically related.

Figured specimens: CPC 15941 (WCB 017/49), 15942 (WCB 102/10), 15943 (WCB 007/41), 15944 (WCB 103/88), 15960 (WCB 017/62), 15961 (WCB 103/59).

Range: Apparatus A A.Z. to *Bispathodus spinulicostatus* A.Z.

Ozarkodina rhenana Bischoff & Ziegler, 1956

Pl. 14, figs. 1-10

1956 *Ozarkodina rhenana* Bischoff & Ziegler, p. 153, pl. 14, fig. 19.

1969 *Ozarkodina rhenana* Bischoff & Ziegler; Druce, 1969, p. 83, pl. 16, fig. 7 (with synonymy).

1969 *Ozarkodina* n. sp. Rexroad, p. 32, pl. 9, fig. 1.

1969 *Bryantodus scitulus* Branson & Mehl; Rexroad, p. 12, pl. 8, fig. 17.

Material studied: 70 specimens.

Description: Variably arched, slightly bowed ozarkodinaform element with subequal anterior and posterior blades. The anterior blade supports 5 to 8 denticles and is usually shorter than the posterior blade, which supports 6 to 9 denticles. The cusp is much larger than any other denticle. All denticles are closely appressed, laterally compressed, and posteriorly directed. The two denticles adjacent to the cusp are much reduced in size

and may not reach the oral surface. Development of the basal cavity is variable. Strongly arched forms have larger basal cavities than those that are nearly flat.

Remarks: The material from this study would seem to indicate a complete intergradation of morphological features of the several species cited in the synonymy. This may be either a reality or a function of the limited material from this study.

Figured specimens: CPC 15945 (WCB 007/6), 15946 (WCB 007/17), 15947 (WCB 011/1), 15948 (WCB 007/26), 15949 (WCB 007/17), 15950 (WCB 013/36), 15951 (WCB 017/49), 15952 (WCB 007/17), 15953 (WCB 017/67), 15954 (WCB 007/29).

Range: Apparatus A A.Z. to *Bispathodus spinulicostatus* A.Z.

Ozarkodina sp. A

Pl. 15, fig. 5

Material studied: 2 specimens.

Description: Ozarkodinaform element with cusp only slightly enlarged, 2 to 4 denticles anterior to the cusp and 5 to 7 posterior denticles. The form is laterally compressed.

Figured specimens: CPC 15959 (WCB 007/40).

Range: Within *Bispathodus spinulicostatus* A.Z.

Genus Patrognathus Rhodes, Austin & Druce, 1969

Type species: *Patrognathus variabilis* Rhodes, Austin & Druce, 1969.

Patrognathus sp. A

Pl. 15, figs. 3, 4

Material studied: 2 specimens.

Description: The anterior blade is relatively long, comprising almost one-half the element length. The posterior denticle of the blade is of greater height than the rest of the blade denticles. The platform has two enlarged denticles on the right margin near the blade. The left platform margin consists of 4 to 5 denticles that continue posteriorly to form a posterior blade, which is broken in both specimens. The right and left platform denticles are not paired. The basal cavity is elongate with a rounded anterior margin.

Remarks: Two specimens, neither complete, are not enough on which to base a species. However, our material is distinct from other species of *Patrognathus* in that it lacks paired denticles on the platform. It is probable that *Patrognathus* sp. A represents the transition from a single-row to a double-row platform element.

Figured specimens: CPC 15957 (LR 1/10), 15958 (LR 1/11).

Range: *Clydagnathus gilwernensis* A.Z.

Genus Polygnathus Hinde, 1879

Type species: *Polygnathus dubia* Hinde, 1879.

Polygnathus burtensis (Druce, 1969)

Pl. 15, fig. 2

1969 *Gnathodus burtensis* Druce, p. 61, pl. 7, figs. 4-6, text-fig. 16.

Material studied: one specimen.

Remarks: The single specimen from this study is identical with the specimens described by Druce from the Bonaparte Gulf area of Western Australia. It is probable that *Polygnathus burtensis* is, as noted by Druce (1969, p. 61), developed from *Polygnathus communis* stock. As it is not related to the general gnathodid development, in that it neither gives rise to nor is deve-

loped from any recognised species of *Gnathodus*, and is morphologically distinct we here assign the species to *Polygnathus*.

Polygnathus burtensis is very similar to a group of *Spathognathodus* species including *S. ohioensis* Merrill, *S. coloradoensis* Murray & Chronic, and *S. orphanus* Merrill from the Pennsylvanian of North America. It is possible that *P. burtensis* may represent the ancestral stock of this group.

Figured specimen: CPC 15956 (WCB 103/76).

Range: *Bispathodus spinulicostatus* A.Z.

Polygnathus communis collinsoni Druce, 1969

Pl. 16, figs. 1-6

1961 *Polygnathus communis* Branson & Mehl (part); Scott & Collinson, p. 130, pl. 1, figs. 8, 10 only.

1969 *Polygnathus collinsoni* Druce p. 93, pl. 23, figs. 3, 4, text-fig. 19.

1969 *Polygnathus communis communis* Branson & Mehl; Druce, p. 94, pl. 18, figs. 8-11.

Material studied: 80 specimens.

Description: A polygnathid with smooth platform surface. The blade is composed of 7 to 10 denticles of near equal height, except for the newly added anterior denticles. The blade line continues as a carina across the platform and a short posterior blade is usually present. The carina may have discrete nodes but usually they are fused and indistinct. The lateral margins of the platform are upturned in juvenile specimens, but the trough formed by this is gradually filled in so that in adult specimens the oral surface appears nearly flat except for slight depressions on either side of the carina. The basal pit is located at the posterior aboral end of the blade-keel. The pit is small and subcircular with a distinct groove extending anteriorly along the aboral blade edge for one-quarter to one-half the blade length. Just posterior to the basal pit is a depression or inversion. The prominence of the inversion decreases with increase in size and age of the specimen. A strong keel runs from the inversion to the posterior tip and may form a short posterior blade in some specimens, especially juveniles. The axis of the specimen is slightly bowed laterally; right and left forms are found.

Remarks: In our material we have a good ontogenetic progression from juvenile to gerontic specimens and we are able to observe progressive morphologic change. Denticles are added at the anterior end of the blade as the size of the specimen increases. The platform extends anteriorly along the blade margin so that the basal pit, which in juveniles is located at the junction between the blade and platform, is located under the anterior portion of the platform. The platform also expands laterally and posteriorly. The cross-section of the platform changes from a distinct 'W' form as the troughs are filled in and the basal inversion becomes less prominent. Large mature specimens may have a short ridge on the left or right anterior platform margin, parallel to the blade. In some specimens this ridge may be nodose.

The species has developed from *Polygnathus communis communis* but is distinguished from the nominate subspecies by a number of morphologic features. The aboral inversion is better developed than in *P. c. communis*. The outer margin of the platform of juvenile specimens is turned up to a greater degree. The basal pit is smaller and the groove extending along the aboral edge of the blade is better developed.

P. communis communis may give rise to *Polygnathus burtensis* via *P. communis collinsoni*. The aboral mor-

phology of juvenile specimens is similar but the inversion is greater in *P. burtensis* and the margins of the platform are less upturned. The basal pits are similar but that of *P. burtensis* is usually larger.

Figured specimens: CPC 15962 (WCB 019/2), 15963 (WCB 019/2), 15964 (WCB 019/2), 15965 (WCB 019/2), 15966 (WCB 019/2), 15967 (WCB 019/2).

Range: *Polygnathus communis collinsoni* A.Z.

***Polygnathus communis communis* Branson & Mehl, 1934**

Pl. 15, fig. 1

1934 *Polygnathus communis* Branson & Mehl, p. 293, pl. 24, figs. 1-4. See Rhodes *et al.* (1969), Thompson (1967) and Thompson & Fellows (1970) for synonymy.

Material studied: 4 specimens.

Remarks: Our material agrees with that described by other authors.

Figured specimen: CPC 15955 (WCB 102/10).

Range: *Clydagnathus gilwernensis* A.Z. to *Bispathodus spinulicostatus* A.Z.

***Polygnathus inornatus* E. R. Branson, 1934**

Pl. 16, figs. 7-9

1934 *Polygnathus inornata* E. R. Branson, p. 309, pl. 25, figs. 8, 26.

1971 *Polygnathus inornata* E. R. Branson; Klapper, pp. 6-7 (with synonymy).

Material studied: 32 specimens.

Remarks: Following Klapper (1971) there appears to be a distinction between *P. inornatus* sensu E. R. Branson (1934) and *P. inornatus* sensu E. B. Branson & Mehl (1934). Until the range of variation of *P. inornatus* from the Hannibal Formation is more clearly defined it is impossible to judge the merits of separating straight and slightly asymmetrical forms. Material from this study tends to be slightly asymmetrical.

Figured specimens: CPC 15968 (WCB 007/3), 15969 (WCB 102/10), 15970 (WCB 102/10).

Range: *Spathognathodus canningensis* A.Z. to *Bispathodus spinulicostatus* A.Z.

***Polygnathus* aff. *P. lacinatus* sensu Rhodes, Austin & Druce, 1969**

Pl. 16, fig. 10

1969 aff. *Polygnathus lacinatus* Huddle; Rhodes, Austin & Druce p. 188, pl. 11.

Material studied: 5 specimens.

Remarks: Our specimens agree in general with material assigned by Rhodes, Austin & Druce (1969, p. 188 ff.) to several subspecies of *P. lacinatus* Huddle (1934). Thompson & Fellows (1970, p. 99) have assigned the type of *P. lacinatus* Huddle (1934, p. 95) to *Pseudopolygnathus fusiformis*. Butler (1973, p. 506) has in turn placed all of the subspecies proposed by Rhodes *et al.* (1969) into *Polygnathus* cf. *P. symmetricus* Branson 1934. Because we have only limited material we are in no position to comment on these assignments.

Figured specimen: CPC 15971 (WCB 212/8).

Range: *Clydagnathus gilwernensis* A.Z.

***Polygnathus thomasi* Druce, 1969**

Pl. 17, figs. 6, 7

1969 *Polygnathus thomasi* Druce, p. 105, pl. 25, figs. 5a, b.

1969 *Polygnathus toxophorus* Cooper; Druce (part), p. 105, pl. 25, figs. 7-9 only.

Material studied: 2 specimens.

Description: An asymmetrical polygnathid with a short blade, about one-third of the length of the specimen. The height of the blade denticles decreases at its junction with the platform, and a denticle row (carina), only slightly elevated above the adjacent platform, extends to the posterior. All denticles of the carina are laterally compressed. The margins of the platform flare outwards and in mature specimens are not noticeably upturned. Transverse ridges run from the platform margin toward the carina but are poorly developed and die out before they reach half-way to the carina. This appears to result, in part at least, by filling of troughs on either side of the carina. The oral surface appears finely punctate or nodose. Aborally the basal cavity is relatively large in juvenile specimens but decreases in relative size in mature specimens. The shape of the cavity is roughly circular with a tail extending toward the posterior along the axis of a well developed keel.

Remarks: The outer margin of the platform extends farther forward than the inner margin. Our material is essentially similar to that illustrated by Druce.

Figured specimens: CPC 15977 (WCB 007/13), 15978 (WCB 013/39).

Range: *Spathognathodus canningensis* A.Z.

?*Polygnathus* sp. A

Pl. 17, figs. 3-5

Material studied: 8 specimens.

Remarks: The eight specimens referred to ?*Polygnathus* sp. A could represent two distinct species. All are characterised by a well developed right margin that is composed of a number of fused lateral denticles. The degree of fusion is variable and in one case a nearly smooth oral surface was observed. The left margin is variably developed but is usually straight and low with fused denticles. A medium carina may or may not be developed and in some cases the carina and left margin appear to overlap. The blade is similar to the blade of *Bispathodus aculeatus plumulus* with 3 or 4 denticles. The basal cavity is also similar to that of *B. aculeatus* in some specimens but become less distinct and more incorporated into the general aboral surface as the platform develops from the less fused denticulate form.

Our material may be related to *Polygnathus parapetus* Druce, but examination of Druce's type specimens does not conclusively demonstrate the relationship. The carina of *P. parapetus* is much better developed than that of our material. From the nature of the cavity, the lateral denticulation, the parapets, and the blade our material appears to be derived from a spathognathodid stock.

Figured specimens: CPC 15974 (WCB 004/8), 15975 (WCB 005/1), 15976 (N 4/9).

Range: *Clydagnathus gilwernensis* A.Z.

***Polygnathus* spp.**

Pl. 17, figs. 1, 2

Material studied: 2 specimens.

Remarks: These two specimens could be juveniles of any number of species of *Polygnathus* or even *Siphonodella*. Both specimens are from the Laurel Formation.

Figured specimens: CPC 15972 (WCB 017/5), 15973 (WCB 011/2).

Genus *Prioniodina* Bassler, 1925

Type species: Prioniodina subcurvata Bassler, 1925.

***Prioniodina? symmetrica* Branson & Mehl, 1934**
Pl. 17, figs. 8-11

1934 *Prioniodina symmetrica* Branson & Mehl, p. 215, pl. 14, fig. 20.

Material studied: 51 specimens.

Description: An arched ozarkodinaform element with discrete, subcircular denticles. The aboral surface in adult specimens is flattened and narrows toward either end. The basal cavity lies within this surface and lacks flared margins. The anterior process has 4 to 6 denticles and the posterior process up to 8 denticles.

Figured specimens: CPC 15979 (WCB 007/38), 15980 (WCB 207/36), 15981 (WCB 101/53), 15982 (WCB 202/27).

Range: *Polygnathus communis collinsoni* A.Z. to *Bispathodus spinulicostatus* A.Z.

Genus *Pseudopolygnathus* Branson & Mehl, 1934

Type species: Pseudopolygnathus primus Branson & Mehl, 1934.

Pseudopolygnathus* cf. *Ps. dentilineatus
E. R. Branson, 1934
Pl. 18, figs. 1-6

1969 *Pseudopolygnathus vogesi* Austin, Rhodes & Druce; Druce, p. 114, pl. 36, fig. 1-7.

Material studied: 80 specimens.

Remarks: There is no well documented illustration of the range of morphologic characteristics included with *Ps. dentilineatus* from topotype material. Our material is most similar to the illustrated specimen of *Ps. brevimarginatus* E. R. Branson, 1934, pl. 26, fig. 3. Both Voges (1959, p. 300) and Klapper (1966, p. 15) place *Ps. brevimarginatus* in synonymy with *Ps. dentilineatus*. If they are correct then our material and that illustrated by Druce (1969, p. 114, pl. 36, figs. 1-7) as *Ps. vogesi* should be assigned to *Ps. dentilineatus*.

Our specimens are characterised by the fusion of the carina denticles rather than their retention as discrete carinal nodes. Development of nodes of the left platform margin is highly variable but nodes are always present on the right margin.

Figured specimens: CPC 15983 (WCB 103/87), 15984 (WCB 103/73), 15985 (WCB 103/73), 15986 (WCB 103/87), 15987 (WCB 103/73), 15988 (WCB 103/87).

Range: *Clydagnathus gilwernensis* A.Z. to *Bispathodus spinulicostatus* A.Z.

***Pseudopolygnathus multistriatus* Mehl & Thomas, 1947**
Pl. 19, figs. 1-6

1947 *Pseudopolygnathus multistriatus* Mehl & Thomas, p. 16, pl. 1, fig. 36.

1967 *Pseudopolygnathus multistriatus* Mehl & Thomas; Thompson, 1967 p. 49, pl. 4, figs. 15, 16, 19, 20.

1973 *Pseudopolygnathus multistriatus* Mehl & Thomas; Butler, 1973, p. 507, pl. 57, figs. 6, 9, 10, 15, 16, 23-25. For synonymy see Thompson (1967) and Butler (1973).

Material studied: 21 specimens.

Remarks: Our material is most similar in oral view to the specimen illustrated by Mehl & Thomas (1947, p. 17, pl. 1, fig. 8) as *Ps. rustica*. Thompson (1967, p. 49) placed *Ps. rustica* in synonymy with *Ps. multistriata*. The basal cavity of most of our specimens is more oval or elongate than that illustrated by either Thompson (1967, pl. 4, figs. 15, 16, 19, 20) or Hass (1959, pl. 47,

figs. 20-25). However, a few of the more mature specimens show a broadening of the anterior margin of the basal cavity. The ontogenetic development of the oral surface appears similar to that illustrated by Haas. In general it appears that the widest part of the platform is posterior to the widest part of the basal cavity.

Figured specimens: CPC 15989 (WCB 101/33), 15990 (WCB 007/31), 15991 (WCB 101/33), 15992 (WCB 101/33), 15993 (WCB 017/53), 15994 (WCB 017/53).

Range: *Spathognathodus canningensis* A.Z. to *Bispathodus spinulicostatus* A.Z.

Pseudopolygnathus* cf. *Ps. nodomarginatus
(E. R. Branson, 1934)
Pl. 19, fig. 7

1934 cf. *Polygnathus nodomarginatus* E. R. Branson, p. 310, pl. 25, fig. 10.

1969 *Pseudopolygnathus nodomarginatus* (E. R. Branson); Rhodes, Austin & Druce, pl. 9, figs. 1-4, pl. 12, figs. 6-8, 10, with synonymy.

Material studied: one specimen.

Remarks: The single specimen observed is very similar to that illustrated by Branson (1934, p. 25, fig. 10). The large basal cavity reconfirms the decision to place the species in the form genus *Pseudopolygnathus* rather than *Polygnathus*.

Figured specimen: CPC 15995 (WCB 017/62).

Range: Within the *Bispathodus spinulicostatus* A.Z.

Genus *Siphonodella* Branson & Mehl, 1944

Type species: Siphonognathus duplicata Branson & Mehl, 1934.

***Siphonodella* cf. *S. cooperi hassi* Thompson & Fellows, 1970**
Pl. 20, fig. 1

1970 *Siphonodella cooperi hassi* Thompson & Fellows, p. 105, pl. 6, figs. 1-5 (includes synonymy).

Material studied: 1 specimen.

Remarks: The single specimen is similar to the material illustrated by Thomson & Fellows.

Figured specimen: CPC 15996 (WCB 012/2).

Range: Within the Apparatus A Assemblage Zone.

***Siphonodella* spp.**
Pl. 20, fig. 20

Material studied: 2 specimens.

Remarks: Two incomplete and indeterminate specimens of *Siphonodella* were recovered from the same level as *S. cf. S. cooperi hassi*.

Figured specimen: CPC 15997 (WCB 212/13).

Genus *Spathognathodus* Branson & Mehl, 1941

Type species: Ctenognathus munchisoni (Pander, 1856).

***Spathognathodus acidentatus* (E. R. Branson, 1934)**

Pl. 20, figs. 3-9; Pl. 21, figs. 1-6; Text-fig. 16

1934 *Spathodus acidentatus* Branson, p. 306, pl. 27, figs. 21, 23.

1939 *Spathodus acidentatus* Branson; Cooper (part), 1939, p. 413 pl. 45, figs. 26, 28 only.

1949 *Spathognathodus acidentatus* Branson; Thomas, p. 4, fig. 7.

1949 *Spathognathodus* sp. B, Thomas, 1949, pl. 2, fig. 31.

Material studied: 173 specimens.

Description: *Spathognathodiform* element with shallow basal cavity. The element is highly variable morphologically but no distinct subgroups have been established. Text-figure 16 outlines some of the variation.

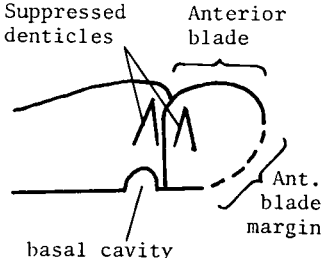
		R	S	T	Totals	
			or 			
1A		19	9	11	39	EXPLANATORY DIAGRAM 
1B		18	7	3	28	
1C		13	6	2	21	
2		11	6	2	19	
Totals		61	28	18	107/173	

Fig. 16. Comparison of blade shape and denticle suppression characters in *Spathognathodus aciedentatus*.

The element has 18 to 28 denticles, including a number of suppressed denticles on some specimens. Some specimens show cap fusion of pairs of denticles. The blade is composed of three to six denticles, usually with two major denticles flanked by minor denticles to the anterior and posterior. The anterior minor denticles are poorly developed and usually show only as crests on the anterior margin. The second of the major denticles is the most prominent denticle of the element and stands above the succeeding minor denticle. The minor denticles following are reduced in size and crowded so that they appear to be bent posteriorly rather than erect. Usually one, or sometimes more, of these denticles is suppressed (text-fig. 16, type 1A, 1C). Denticles above the basal cavity are taller than those just anterior to the cavity but not as high as the two major blade denticles. Many specimens have a suppressed denticle over the apex of the basal cavity (text-fig. 16, type 1A, 1B). From the basal cavity to the posterior margin the height of the denticles gradually decreases.

Three types of anterior aboral blade margins are recognised. These are type R with a right angle, type S with an upward slope and vertical anterior margin, and type T with a smooth curve. Type R is the most abundant form (see text-fig. 16).

Most specimens are orally straight, or only slightly bowed, and are not arched aborally. The basal cavity is near or slightly anterior to mid-length, has a rounded anterior margin and thick narrow flanges, and tapers posteriorly, usually not extending as far as the posterior third of the specimen. The cavity is relatively shallow.

Remarks: Both Klapper (1966) and Thompson & Fellows (1970) place *S. aciedentatus* in synonymy with *S. stabilis*. However, we believe that the two species can be distinguished on the morphology of the basal cavity and on the lateral profile resulting from denticle development. The basal cavity of *S. aciedentatus* is similar in shape to that of *S. stabilis* but is less prominent and does not extend to the posterior margin. From the anterior margin the denticle profile of *S. stabilis* descends evenly to past mid-length, but the profile of *S. aciedentatus* is depressed just anterior to the basal cavity, where several denticles of reduced size follow the major denticles. *S. aciedentatus* is distinguished from *S. macer* by having a less rounded basal cavity and by the lateral profile of the denticle row.

Figured specimens: CPC 15998 (WCB 212/1), 15999 (WCB 202/3), 16000 (WCB 201/4), 16001 (WCB 202/27), 16002 (WCB 218/5), 16003 (WCB 001/9), 16004 (WCB 001/9), 16005 (WCB 002/1), 16006 (WCB

002/10), 16007 (WCB 002/9), 16008 (WCB 202/24), 16009 (WCB 002/6), 16010 (WCB 206/26).

Range: Unnamed zone ('birdseye limestone') to *Icriodus platys* A.Z.

Spathognathodus canningensis sp. nov.

Pl. 22, figs. 1-5

Derivation of name: From the Canning Basin in Western Australia.

Material studied: 81 specimens.

Description: Pa element with prominent anterior denticles and subcentral basal cavity. Juvenile specimens have as few as 12 denticles and adult specimens with 27 denticles have been recorded. The blade consists of 3 to 9 denticles that first increase and then decrease in height with one or two major denticles near the anterior end. The lowest anterior denticle height is just anterior to the basal cavity. From the basal cavity to the posterior end the denticles remain level for a distance and then gradually decrease in height. The posterior denticles are nearly of equal size but increase slightly toward the posterior. Oral terminations of denticles tend to be discrete and pointed. The basal cavity outline changes with size. Juvenile specimens have cavities pointed at either end, and taper to nearly the posterior margin. Adult specimens develop a more rounded anterior margin to the cavity, and growth of the posterior margin extends the flange well beyond the cavity. The aboral margin is straight, or nearly so, with no observed arching. Adult specimens may have lateral thickening of the blade, and minor secondary denticulation may be present along the oral blade margin.

Remarks: This material is very similar in lateral view to specimens illustrated by Branson (1934, pl. 27, figs. 15, 22) as *S. sulciferus* but they lack the complex crenulation of the posterior portion of the oral surface. They are also similar to specimens illustrated by Druce as *S. cyrius cyrius* (1969, p. 129, pl. 28, figs. 4, 5) but differ by having a flatter aboral margin and fewer denticles.

Figured specimens: CPC 16011 (WCB 103/76), 16012 (WCB 103/76) Holotype 16013 (WCB 103/60), 16014 (WCB 102/10), 16015 (WCB 017/15).

Range: *Spathognathodus canningensis* A.Z. to *Bispathodus spinulicostatus* A.Z.

Spathognathodus crassidentatus (Branson & Mehl, 1934)

Pl. 23, figs. 1-5

1934 *Spathodus crassidentatus* Branson & Mehl, p. 276, pl. 22, figs. 17, 18.

- 1934 *Spathodus crassidentatus* Branson & Mehl; Branson, 1934, p. 303, pl. 27, fig. 12.
 1964 *Spathognathodus regularis* (Branson & Mehl); Rexroad & Scott, p. 49, pl. 3, figs. 1, 2.
 1966 *Spathognathodus crassidentatus* (Branson & Mehl); Klapper, p. 23, pl. 5, figs. 15-17.
 1966 *Spathognathodus stabilis* (Branson & Mehl); Klapper (part), p. 23, pl. 5, fig. 6 only.
 1970 *Spathognathodus crassidentatus* (Branson & Mehl); Thompson & Fellows, p. 111, pl. 7, figs. 8, 14.

Material studied: 86 specimens.

Remarks: Our material is similar to specimens illustrated by Branson & Mehl (1934) and Thompson & Fellows (1970). Most of our specimens appear to be juveniles; the denticles at the anterior end are not as well developed as those on specimens illustrated by other authors.

We believe that *S. regularis* (Branson & Mehl) can be distinguished from *S. crassidentatus* by the morphology of the anterior margin and basal cavity. The anterior margin of the blade of *S. crassidentatus* is nearly at right angles to the basal margin or may be slightly posteriorly recurved. The anterior margin of *S. regularis* is more similar to the pattern found in *Anchignathodus cristulus* in that it is straight and angled slightly posteriorly. *S. crassidentatus* may have one or more minor denticles developed on the anterior margin ahead of the two major blade denticles. In *S. regularis* the basal cavity begins immediately after the major blade denticle(s), but in *S. crassidentatus* one to three minor denticles are located between the basal cavity and the major blade denticles. The flanges of the basal cavity do not appear to extend as far aborally in *S. crassidentatus* as they do in *S. regularis*.

On morphologic grounds we suggest the following phylogenetic sequence:

S. stabilis → *S. crassidentatus* → *S. regularis* → *A. cristulus*
 There is a progressive reduction in number and increase in size of the anterior blade denticles as well as a tendency for the axial length of the posterior denticles to increase.

Figured specimens: CPC 16018 (WCB 007/26), 16019 (WCB 102/12), 16020 (WCB 207/8), 16021 (WCB 017/42), 16022 (WCB 222/9).

Range: Throughout the sequence.

***Spathognathodus mehlbrai* sp. nov.**

Pl. 23, figs. 6-9

- 1938 *Spathodus elongatus* Branson & Mehl (part), p. 139, pl. 34, fig. 9 only (not fig. 6 = ?*S. macer*).
 1969 *Spathognathodus elongatus* (Branson & Mehl); Rhodes et al. (part) 1969, p. 228, pl. 7, figs. 4, 5 only.

Derivation of name: After E. B. Branson and M. G. Mehl who originally illustrated the species.

Material studied: 40 specimens.

Description: Spathognathodiform element with sub-central basal cavity and single denticle row. Specimens are laterally bowed and very slightly arched. The denticle row is uneven with the highest and largest denticles at the anterior. Denticles may be discrete near their apex, laterally compressed, and are not uniform in size. Some specimens have numerous suppressed denticles and may show cap fusion. The basal cavity is in the central third and has a sharply tapered anterior end and a long tapered posterior that extends to near the posterior margin. The cavity is shallow and narrow so that on larger individuals (such as Pl. 23, fig. 9) the posterior portion of the cavity is masked by lateral

thickening of the specimens and the cavity appears to be very restricted. Anterior to the cavity the aboral margin is slightly upturned.

Remarks: Branson & Mehl (1938, pl. 34) illustrated two specimens, the holotype (U.M., C351-5; = fig. 6) and a paratype (U.M., C348-2; = fig. 9). Most authors agree that the two specimens are dissimilar, but there all agreement ends. Klapper (1969, p. 23) assigns figure 9 to *S. stabilis*. Rhodes et al. (1969, p. 226, 228) assign figure 9 to *S. crassidentatus* and retain figure 6 as *S. elongatus*. Thompson & Fellows (1970, p. 112) retain figure 9 (the paratype) in *S. elongatus* and assign figure 6 (the holotype) to *S. macer*. In 1967, Thompson (p. 54, pl. 1, fig. 15) illustrated a specimen he assigned to *S. elongatus* but which we feel is probably closer to *S. macer* and does not conform to either his or to Branson & Mehl's description of *S. elongatus*. This would cast some doubt on other identifications of *S. elongatus* by Thompson (1967) and Thompson & Fellows (1970) except that their descriptions compare favourably with the Branson & Mehl description and with the paratype. Our material is similar to the Branson & Mehl *S. elongatus* paratype (1938, pl. 34, fig. 9) and agrees with their description.

Figured specimens: CPC 16023 (WCB 019/2), 16024 (WCB 019/3) holotype, 16025 (WCB 002/14A), 16026 (WCB 212/0).

Range: Unnamed zone ('birdseye limestone') to *Icriodus platys* A.Z.

***Spathognathodus* cf. *S. robustus* (Branson & Mehl, 1934)**

Pl. 25, figs. 1-6

- 1934 cf. *Spathodus robustus* Branson & Mehl p. 189, pl. 17, fig. 21.
 1969 *Spathognathodus* cf. *S. robustus* (Branson & Mehl); Rhodes, Austin & Druce, p. 235, pl. 7, figs. 6, 7.
 1969 *Spathognathodus* cf. *S. robustus* (Branson & Mehl); Druce, p. 133, pl. 28, fig. 7, pl. 32, fig. 2.
 1969 *Spathognathodus* cf. *S. robustus* subsp. nov. A, Druce, p. 134, pl. 32, fig. 6.

Material studied: 26 specimens.

Remarks: Specimens from this study appear to be conspecific with material illustrated by Rhodes, Austin & Druce (1969) and Druce (1969). Our material differs in a number of ways from the type specimen. Branson & Mehl indicate that their specimens have a thickened anterior blade and that the posterior was flexed sharply inward. Our material is not markedly thickened nor is there a sharp posterior flexure, but the posterior is slightly twisted and inwardly flexed. We do not know the number of specimens on which Branson & Mehl based their species concept, and they illustrated only one specimen. Some conodont species tend to become markedly thick in adult or gerontic specimens and perhaps Branson & Mehl's description is based on a limited number of these specimens. The differences in posterior lateral flexure may also reflect the thickening, which could enhance the apparent flexure. The basal cavity of our material is centrally located but more restricted than that described by Branson & Mehl. Thickening of the lateral margins would tend to emphasise the basal cavity and extend it along the aboral margin.

The oral outline with its irregular denticle profile, the variable denticle size, and the posteriorly inclined anterior margin are similarities between our material and that described by Branson & Mehl. Our material shows one or more enlarged anterior denticles, and a

number of specimens have numerous non-eruptive denticles that are suppressed at early growth stages.

Figured specimens: CPC 16033 (WCB 103/23), 16034 (WCB 007/17), 16035 (WCB 103/87), 16036 (WCB 007/38), 16037 (WCB 017/67), 16038 (WCB 007/40).

Range: Middle Apparatus A A.Z. to *Bispathodus spinulicostatus* A.Z.

Spathognathodus? sp. nov. A

Pl. 27, figs. 1-5

Material studied: 11 specimens.

Description: Spathognathodiform element with laterally expanded oral margin. The element consists of a high anterior blade usually composed of a single large denticle with minor serrations on the anterior face. The blade is twice the height of the rest of the element and is slightly posteriorly inclined. The post-blade portion is composed of 14 to 18 denticles of subequal size. These denticles, especially those near the basal cavity, are laterally expanded from base to top. In oral view they appear as transverse ridges or nodes separated by a slight depression. No irregular central groove or trough is present. The posterior portion of the element is slightly downturned. The basal cavity is elongate with wide margins. In juvenile specimens the cavity is shallow with the edges flared outward and down. In adult specimens the attachment area is nearly flat with an axial groove and small pit near the anterior end. A short posterior keel is observed in the more mature specimens. The attachment area is covered with concentric growth ridges. Specimens are slightly arched and the aboral blade margin is angled upwards. The more mature specimens are laterally bowed and the outer flange of the cavity is generally larger than the inner flange.

Remarks: Viewed laterally the outline of the specimens is generally similar to that of *Bispathodus aculeatus plumulus*. However, it is distinguished from this species by the lateral expansion of the denticle row and the character of the basal cavity. This element is different from other platform or platform-trending elements in that the denticles appear to be laterally expanded rather than expansion being initiated by the development of

separate lateral nodes or peg-like denticles as in *Clydagnathus* or *Bispathodus aculeatus aculeatus*.

Figured specimens: CPC 16045 (WCB 218/1), 16046 (WCB 218/1), 16047 (WCB 218/1), 16048 (WCB 218/1), 16049 (WCB 218/1).

Range: Unnamed zone ('birdseye limestone').

Genus Synprioniodina Bassler, 1925

Type species: *Synprioniodina alternata* Ulrich & Bassler, 1926.

Synprioniodina regularis E. R. Branson, 1934

Pl. 28, figs. 1-3

1934 *Euprioniodina regularis* E. R. Branson, p. 330, pl. 38, fig. 1.

1969 *Synprioniodina regularis regularis* (E. R. Branson); Rexroad, p. 49, pl. 8, figs. 7, 8.

1969 *Synprioniodina regularis asema* (Cooper); Rexroad, p. 50, pl. 8, figs. 10, 11.

1969 *Synprioniodina regularis devexa* (Huddle); Rexroad, p. 50, pl. 8, figs. 12-14.

(for synonymy see Rexroad, 1969).

Material studied: 148 specimens.

Remarks: Forms representing all three subspecies of *S. regularis* as recognised by Rexroad (1969) were found in this study. However, we do not have enough specimens to justify division of our material into separate subspecies.

Figured specimens: CPC 16050 (WCB 007/40), 16051 (WCB 017/44), 16052 (WCB 206/9).

Range: Unnamed zone ('birdseye limestone') to the middle *Bispathodus spinulicostatus* A.Z.

Gen. et sp. indet. A

Pl. 28, fig. 4

Material studied: 1 specimen.

Remarks: This specimen may represent a pathologic variant of a spathognathodiform element. Its basal cavity is spathognathodid in form. The anterior end of the specimen is somewhat similar to a neoprioniodid or synprioniodinid, and over the basal cavity is a single tall denticle.

Figured specimen: CPC 16053 (WCB 006/13).

Range: within the *Clydagnathus gilwernensis* A.Z.

PLATE 1
All figures x50

Pelekysgnathus australis (I element) sp. nov.
(p. 17)

- 1 a—left lateral view. b—right lateral view. c—aboral view. d—oral view.
CPC 15816 (WCB 010/26) Paratype.
- 2 a—left lateral view. b—right lateral view. c—aboral view. d—oral view.
CPC 15817 (WCB 010/26) Paratype.
- 3 left lateral view of juvenile specimen. CPC 15818 (WCB 001/9) Paratype.
- 4 a—oral view. b—aboral view. CPC 15819 (WCB 219/5) Paratype.
- 5 a—left lateral view. b—right lateral view. c—oral view. d—aboral view.
CPC 15820 (WCB 010/26) **Holotype**.
- 6 a—left lateral view. b—right lateral view. c—oral view. d—aboral view.
CPC 15821 (WCB 010/16) Paratype.
- 7 a—left lateral view. b—right lateral view. c—oral view. d—aboral view.
CPC 15822 (WCB 010/9) Paratype.

Pelekysgnathus australis (S₂ element) sp. nov.
(p. 18)

- 8 a—left lateral view. b—right lateral view. CPC 15823 (WCB 205/2) Paratype.

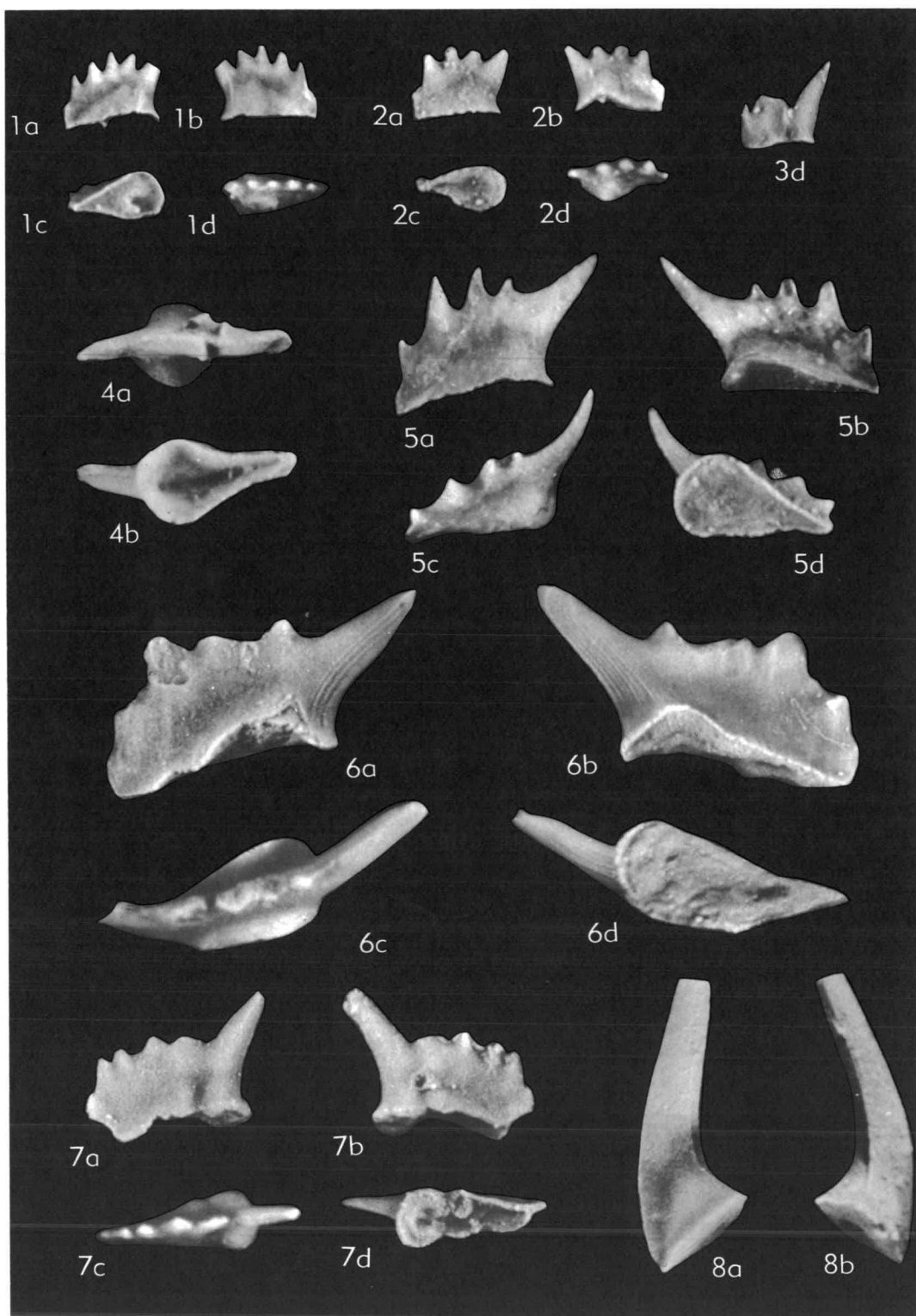


PLATE 2
All figures x50

***Pelekysgnathus australis* (S_2 element) sp. nov.**
(p. 18)

- 1 a—left lateral view. b—aboral view. c—right lateral view. CPC 15824 (WCB 010/26) Paratype.
- 2 a—left lateral view. b—right lateral view. CPC 15825 (WCB 206/8) Paratype.
- 3 a—left lateral view. b—aboral view. c—right lateral view. CPC 15826 (WCB 010/26) Paratype.
- 4 a—left lateral view. b—aboral view. c—right lateral view. CPC 15827 (WCB 010/13) Paratype.
- 5 a—left lateral view. b—aboral view. c—right lateral view. CPC 15828 (WCB 010/26) Paratype.

***Pelekysgnathus australis* (M_{2a} element) sp. nov.**
(p. 18)

- 6 a—left lateral view. b—right lateral view. CPC 15829 (WCB 002/1) Paratype.
- 7 a—left lateral view. b—right lateral view. CPC 15830 (WCB 202/6) Paratype.
- 8 a—aboral-lateral view. b—lateral view. CPC 15831 (WCB 218/1) Paratype.
- 9 a—aboral-lateral view. b—lateral view. CPC 15832 (WCB 202/6) Paratype.
- 10 a—left lateral view. b—right lateral view. CPC 15833 (WCB 002/1) Paratype.
- 11 a—left lateral view. b—right lateral view. CPC 15834 (WCB 218/1) Paratype.

***Pelekysgnathus australis* (M_{2b} element) sp. nov.**
(p. 18)

- 12 a—left lateral view. b—posterior-aboral view. c—right lateral view. CPC 15835 (WCB 010/26) Paratype.
- 13 a—left lateral view. b—right lateral view. CPC 15836 (WCB 010/17) Paratype.

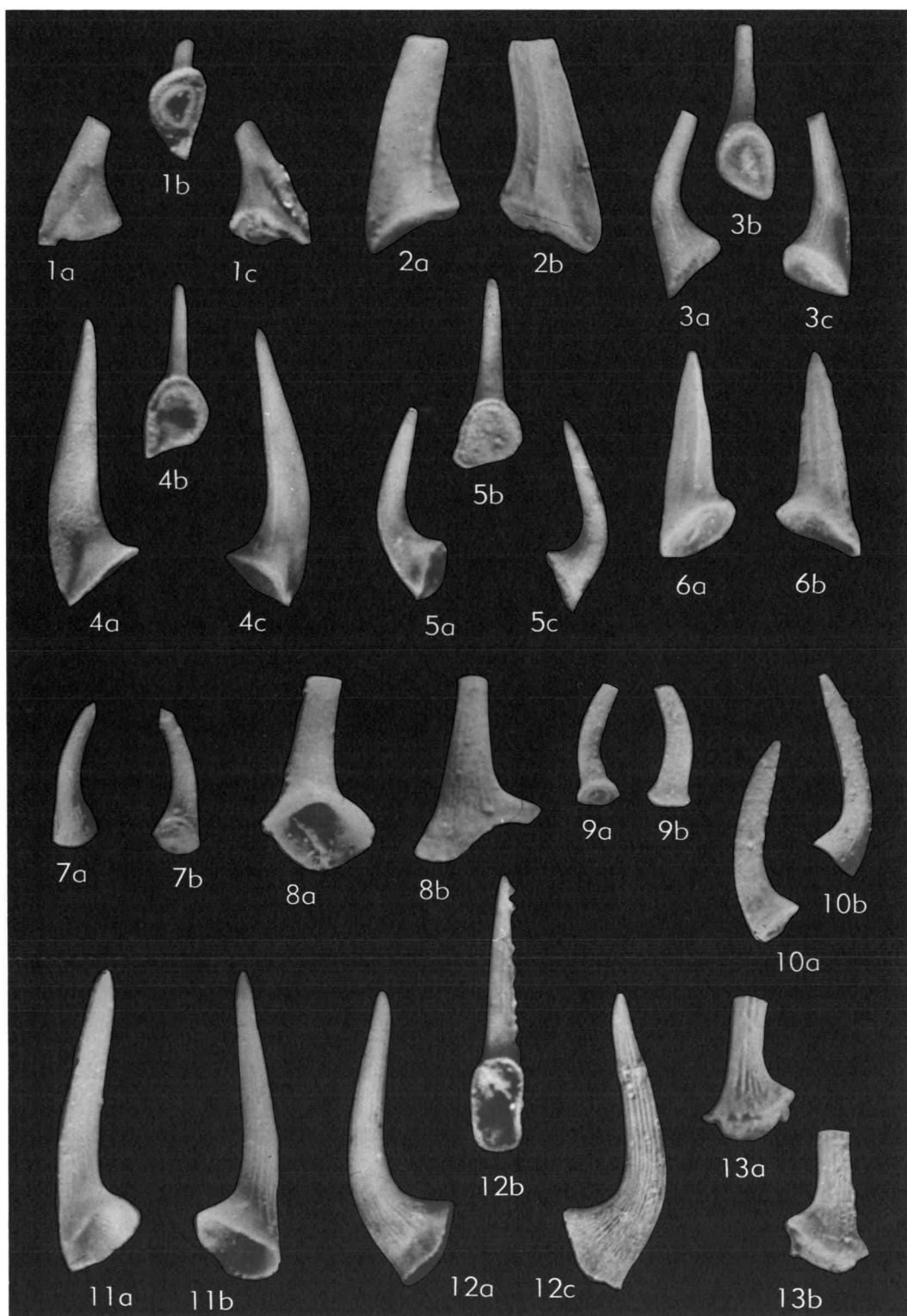


PLATE 3
All figures x50

Pelekysgnathus australis (M_{2b} element) sp. nov.
(p. 18)

- 1 a—left lateral view. b—right lateral view. CPC 15837 (WCB 201/2) Paratype.
- 2 a—aboral view. b—right lateral view. CPC 15838 (WCB 010/26) Paratype.
- 3 a—aboral view. b—right lateral view. CPC 15839 (WCB 001/9) Paratype.
- 4 a—left lateral view. b—right lateral view. CPC 15840 (WCB 205/2) Paratype.

APPARATUS A (Pb element)
(p. 19)

- 5 a—left lateral view. b—right lateral view. CPC 15841 (WCB 104/38).
- 6 a—right lateral view. b—left lateral view. CPC 15842 (WCB 104/30).

APPARATUS A (N element)
(p. 19)

- 7 a—inner lateral view. b—outer lateral view. CPC 15843 (WCB 012/2).
- 8 a—inner lateral view. b—outer lateral view. CPC 15844 (WCB 012/2).
- 9 a—inner lateral view. b—outer lateral view. CPC 15845 (WCB 013/39).

APPARATUS A (Sc element)
(p. 19)

- 10 a—inner lateral view. b—outer lateral view. CPC 15846 (WCB 012/2).
- 11 a—inner lateral view. b—outer lateral view. CPC 15847 (WCB 012/2).

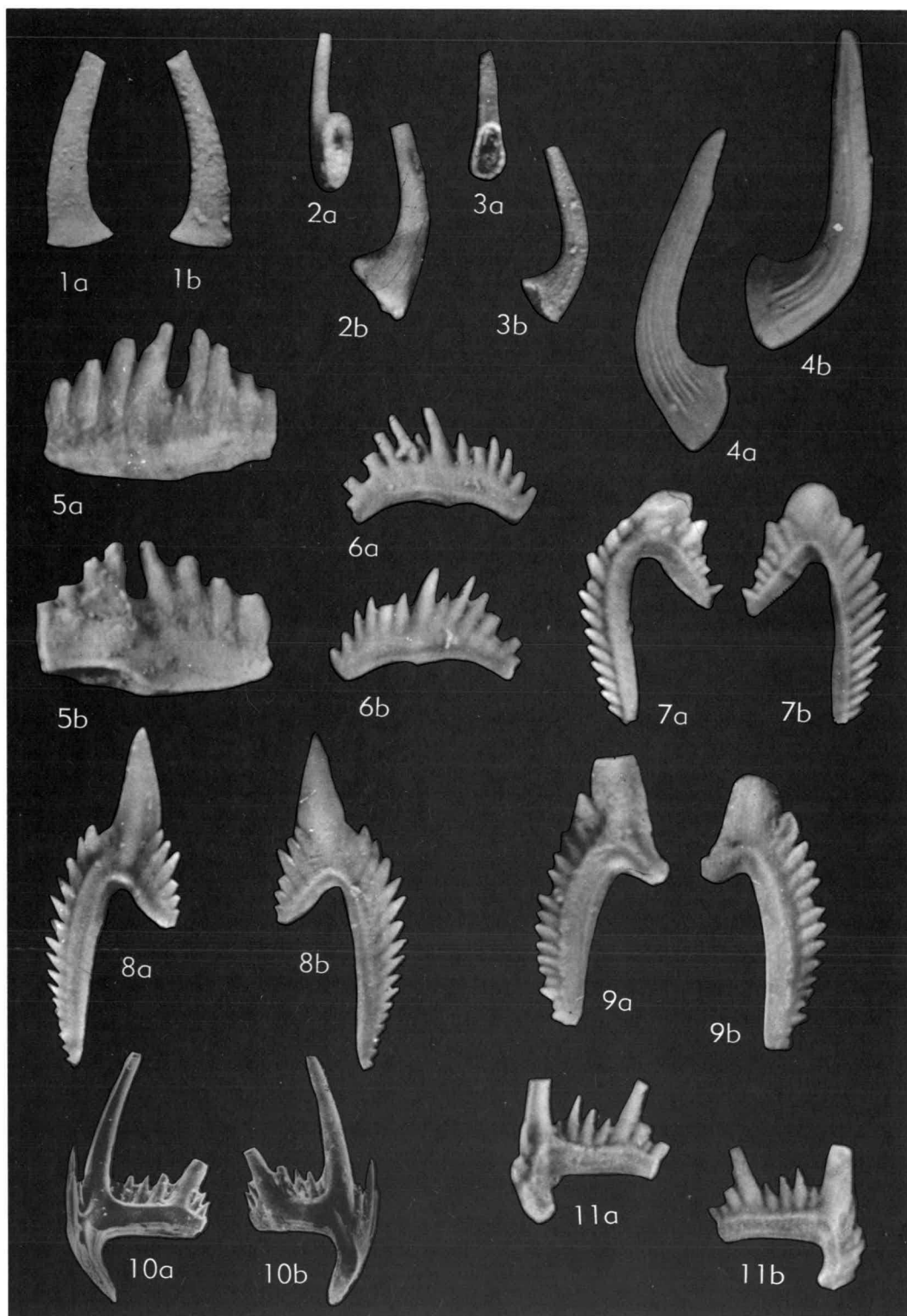


PLATE 4
All figures x50

APPARATUS A (Sc element)
(p. 19)

- 1 a—outer lateral view. b—inner lateral view. CPC 15848 (WCB 013/39).
- 2 a—inner lateral view. b—outer lateral view. CPC 15849 (WCB 013/20).

APPARATUS A (Sb element)
(p. 20)

- 3 a—inner lateral view. b—outer lateral view. CPC 15850 (WCB 012/2).
- 4 a—inner lateral view. b—outer lateral view. CPC 15851 (WCB 012/3).
- 5 a—inner lateral view. b—outer lateral view. CPC 15852 (WCB 104/45).
- 6 a—outer lateral view. b—inner lateral view. CPC 15853 (WCB 012/3).

APPARATUS A (Sa element)
(p. 19)

- 7 a—posterior view. b—anterior view. CPC 15854 (WCB 012/2).
- 8 a— left lateral view. b—right lateral view. CPC 15855 (WCB 012/2).
- 9 a—anterior view. b—right lateral view. c—posterior view. CPC 15856 (WCB 012/2).

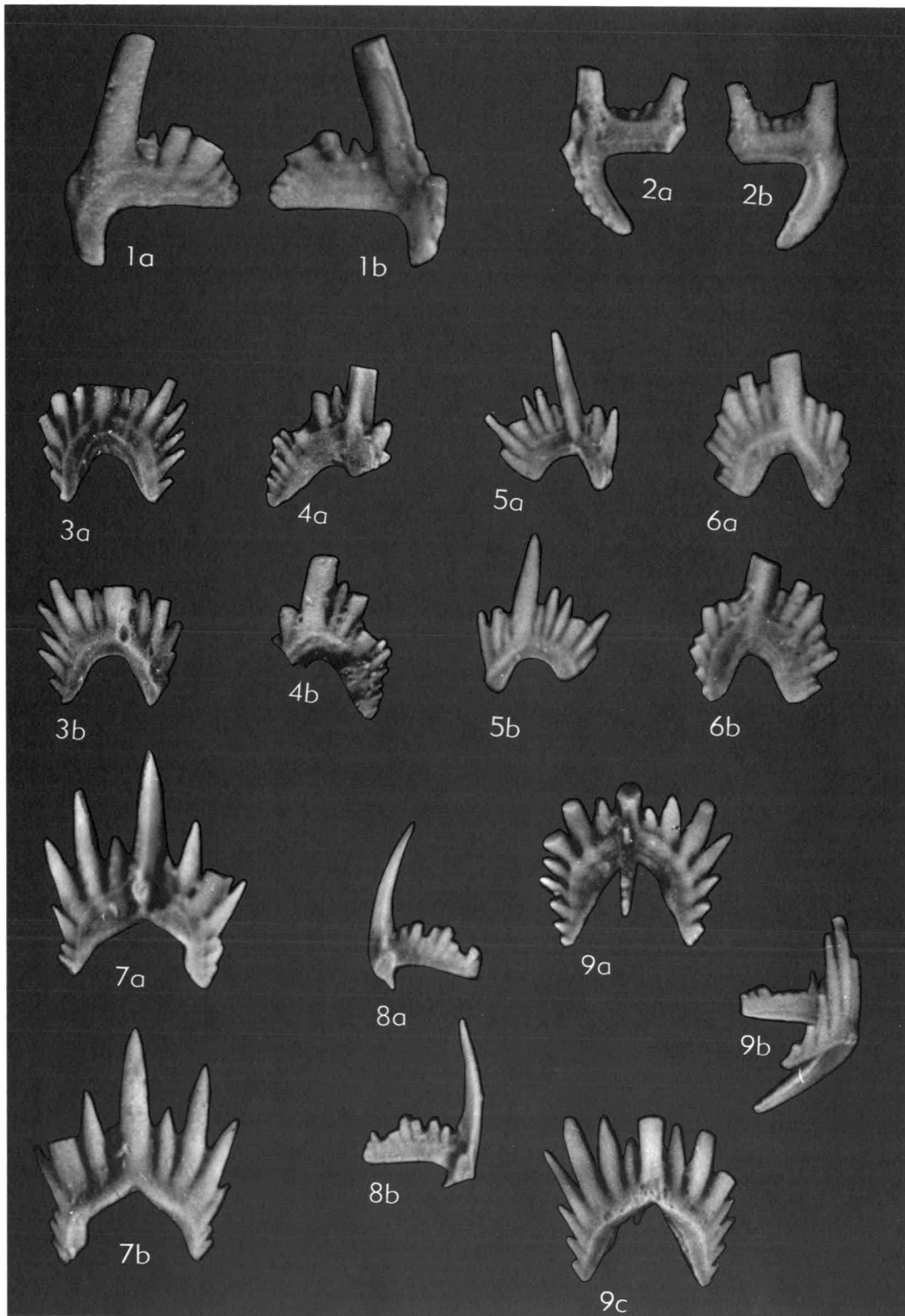


PLATE 5
All figures x50

Acodina sp. A
(p. 20)

- 1 a—inner lateral view. b—outer lateral view. c—aboral view. CPC 15857 (WCB 001/9).
- 2 a—inner lateral view. b—outer lateral view. c—aboral view. CPC 15858 (WCB 001/9).
- 3 a—inner lateral view. b—aboral-inner lateral view. CPC 15859 (WCB 202/7).
- 4 a—inner lateral view. b—outer lateral view. CPC 15860 (WCB 202/25).

Acodina sp. B
(p. 20)

- 5 a—inner lateral view. b—outer lateral view. c—aboral view. CPC 15861 (WCB 001/17).
- 6 a—inner lateral view. b—outer lateral view. c—aboral view. CPC 15862 (WCB 201/11).

Anchignathodus cristulus (Youngquist & Miller, 1949)
(p. 20)

- 7 left lateral view. CPC 15863 (WCB 013/20).
- 8 a—right later view. b—left lateral view. CPC 15864 (WCB 012/2).
- 9 left lateral view. CPC 15865 (WCB 204/25).
- 10 left lateral view. CPC 15866 (WCB 101/23).
- 11 left lateral view. CPC 15867 (WCB 103/63).
- 12 left lateral view. CPC 15868 (WCB 012/2).

Angulodus compressa (Huddle, 1934)
(p. 21)

- 13 inner lateral view. CPC 15869 (WCB 017/20).
- 14 inner lateral view. CPC 15870 (WCB 210/9).
- 15 inner lateral view. CPC 15871 (WCB 007/23).

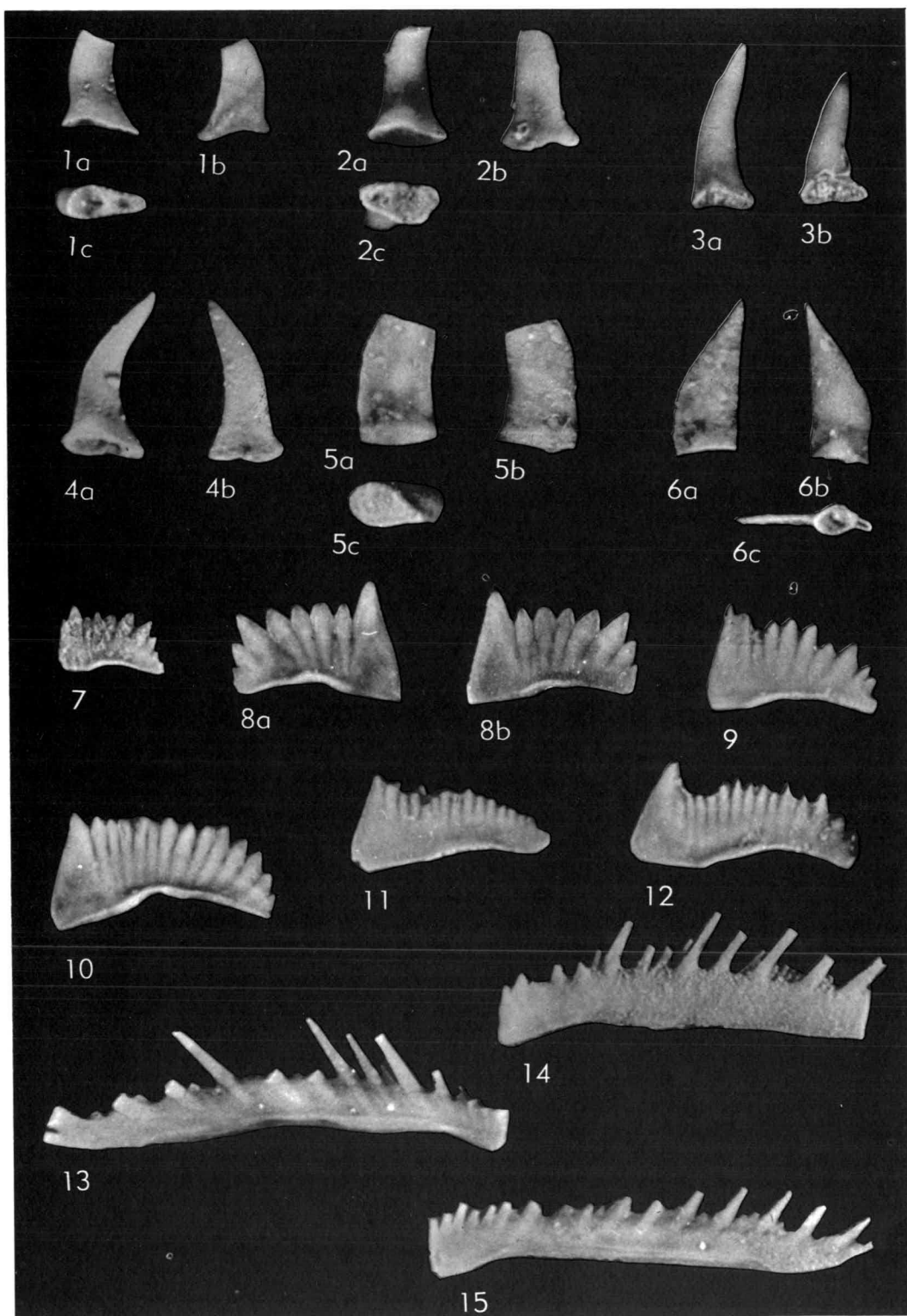


PLATE 6
All figures x50

Angulodus pergracilis (Ulrich & Bassler, 1926)
(p. 21)

- 1 inner lateral view. CPC 15872 (WCB 007/27).
- 2 inner lateral view. CPC 15873 (WCB 218/5).
- 3 inner lateral view. CPC 15874 (WCB 007/26).
- 4 inner lateral view. CPC 15875 (WCB 019/2).
- 5 inner lateral view. CPC 15876 (WCB 007/40).

Clydagnathus gilwernensis Rhodes, Austin & Druce, 1969
(p. 23)

- 6 a—right lateral view. b—left lateral view. c—oral view. d—aboral view.
CPC 15877 (LR 2/10).
- 8 a—right lateral view. b—left lateral view. c—aboral view. d—oral view.
CPC 15878 (WCB 007/3).

Clydagnathus cavusformis Rhodes, Austin & Druce, 1969
(p. 22)

- 7 a—oral view. b—left lateral view. c—right lateral view. d—aboral view.
CPC 15879 (LR 2/10).
- 9 a—oral view. b—left lateral view. c—aboral view. CPC 15880 (WCB
006/9).

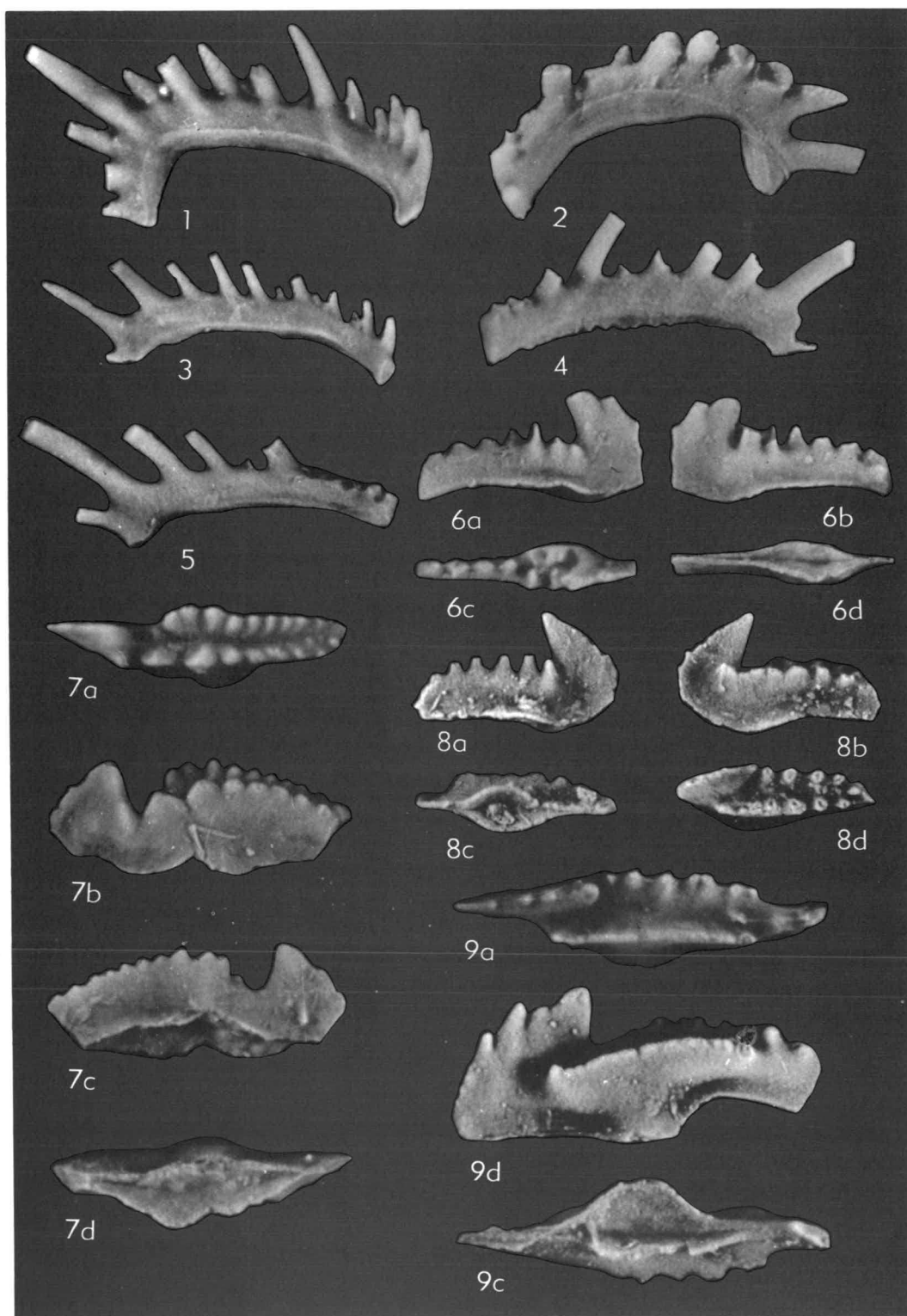


PLATE 7
All figures x50

Clydagnathus cavusformis Rhodes, Austin & Druce, 1969
(p. 22)

- 1 a—right lateral view. b—left lateral view. c—aboral view. d—oral view.
CPC 15881 (WCB 007/30).
- 2 a—right lateral view. b—left lateral view. c—aboral view. d—oral view.
CPC 15882 (WCB 007/41).
- 3 a—left lateral view. b—oral view. c—aboral view. d—right lateral view.
CPC 15883 (WCB 007/30).

Dinodus sp.
(p. 24)

- 4 inner later view. CPC 15884 (WCB 012/2).

Gnathodus sp.
(p. 24)

- 5 a—oral view. b. left lateral view. c—aboral view. CPC 15885 (WCB 103/1).

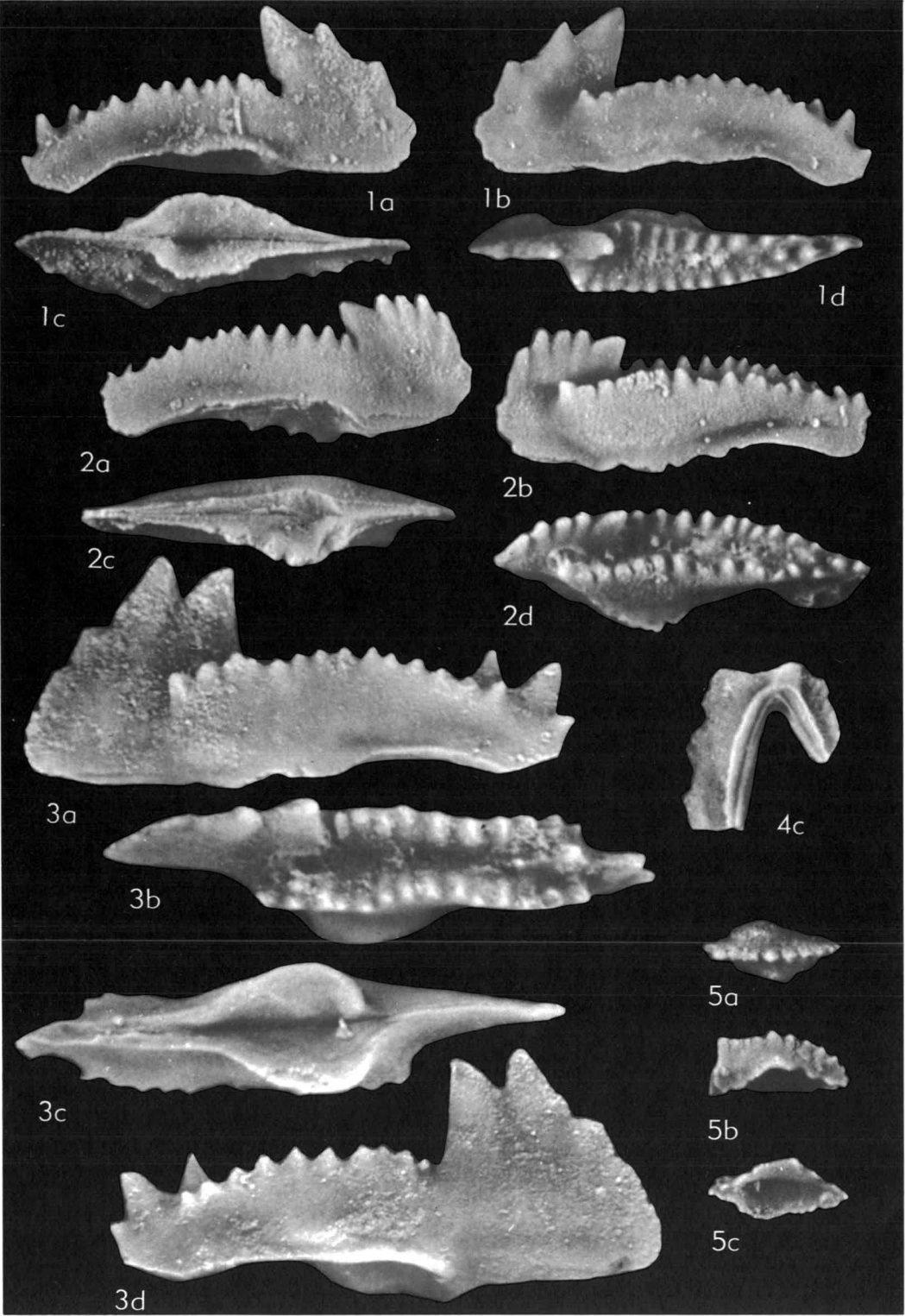


PLATE 8
All figures x50

Hibbardella brevialata (Branson & Mehl, 1934)
(p. 24)

- 1 a—left lateral view. b—right lateral view. CPC 15886 (WCB 102/10).

Hibbardella? helmsi new name
(p. 24)

- 2 a—posterior view. b—anterior-lateral view. CPC 15887 (WCB 002/13).

Hibbardella cf. **H. insignis** Huddle, 1934
(p. 24)

- 3 a—posterior view. b—aboral view. c—right lateral view. CPC 15888 (WCB 007/23).
4 posterior view. CPC 15889 (WCB 007/41).
5 a—posterior view. b—anterior view. CPC 15890 (WCB 202/29).

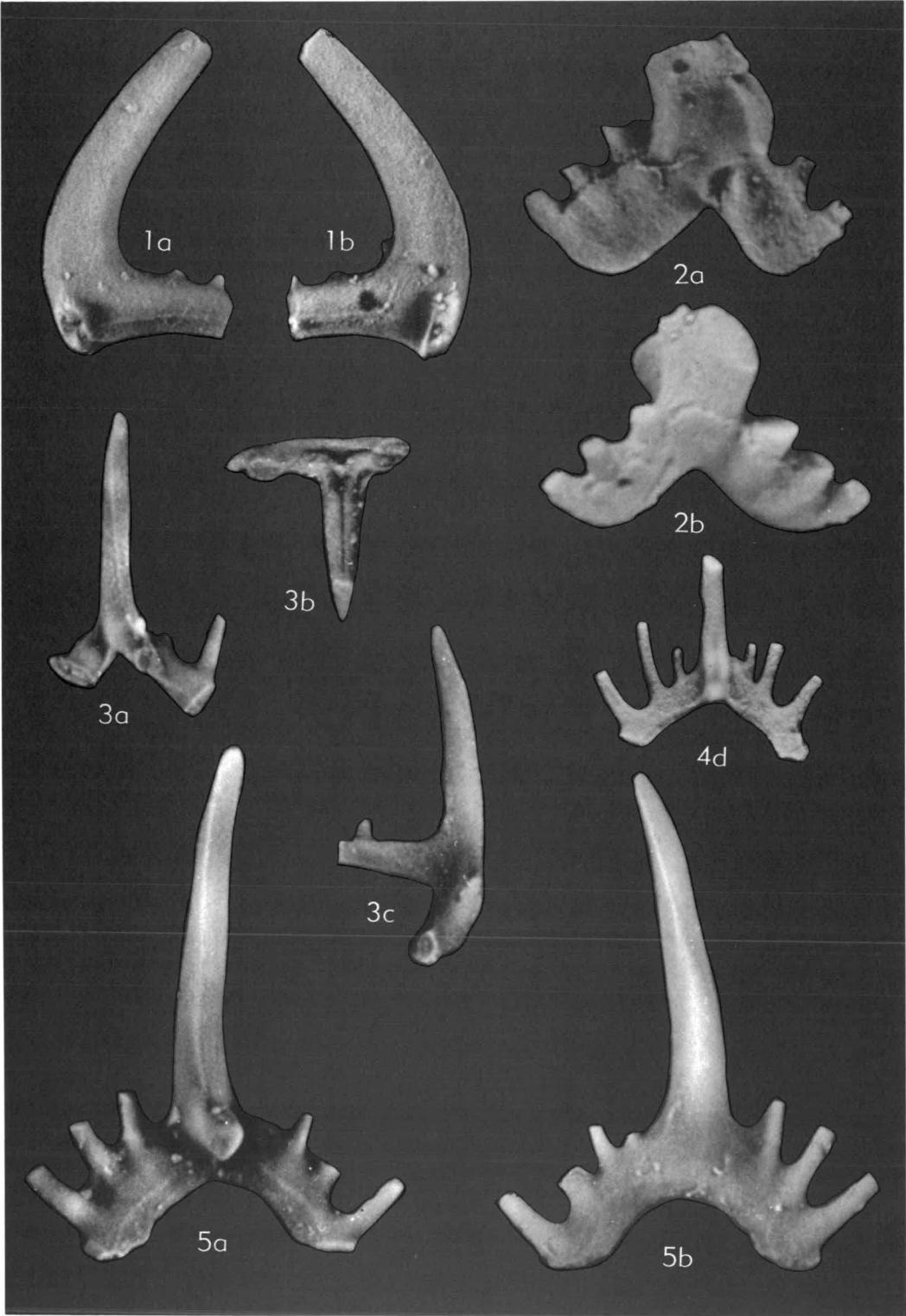


PLATE 9
All figures x50

Hibbardella cf. **H. micra** (Cooper, 1939)
(p. 25)

- 1 a—posterior view. b—anterior view. CPC 15891 (WCB 017/34).
- 2 a—posterior view. b—aboral view. c—right lateral view. CPC 15892 (WCB 017/34).
- 3 a—right lateral view. b—posterior view. c—aboral view. CPC 15893 (WCB 017/15).
- 5 a—left lateral view. b—posterior view. c—aboral view. CPC 15896 (WCB 017/34).
- 6 a—left lateral view. b—posterior view. CPC 15894 (WCB 010/8).

Hibbardella (Hibbardella) sp. nov. Druce, 1969
(p. 25)

- 4 a—posterior view. b—anterior view. CPC 15895 (WCB 202/29).
- 7 a—aboral view. b—left lateral view. CPC 15897 (WCB 202/14).

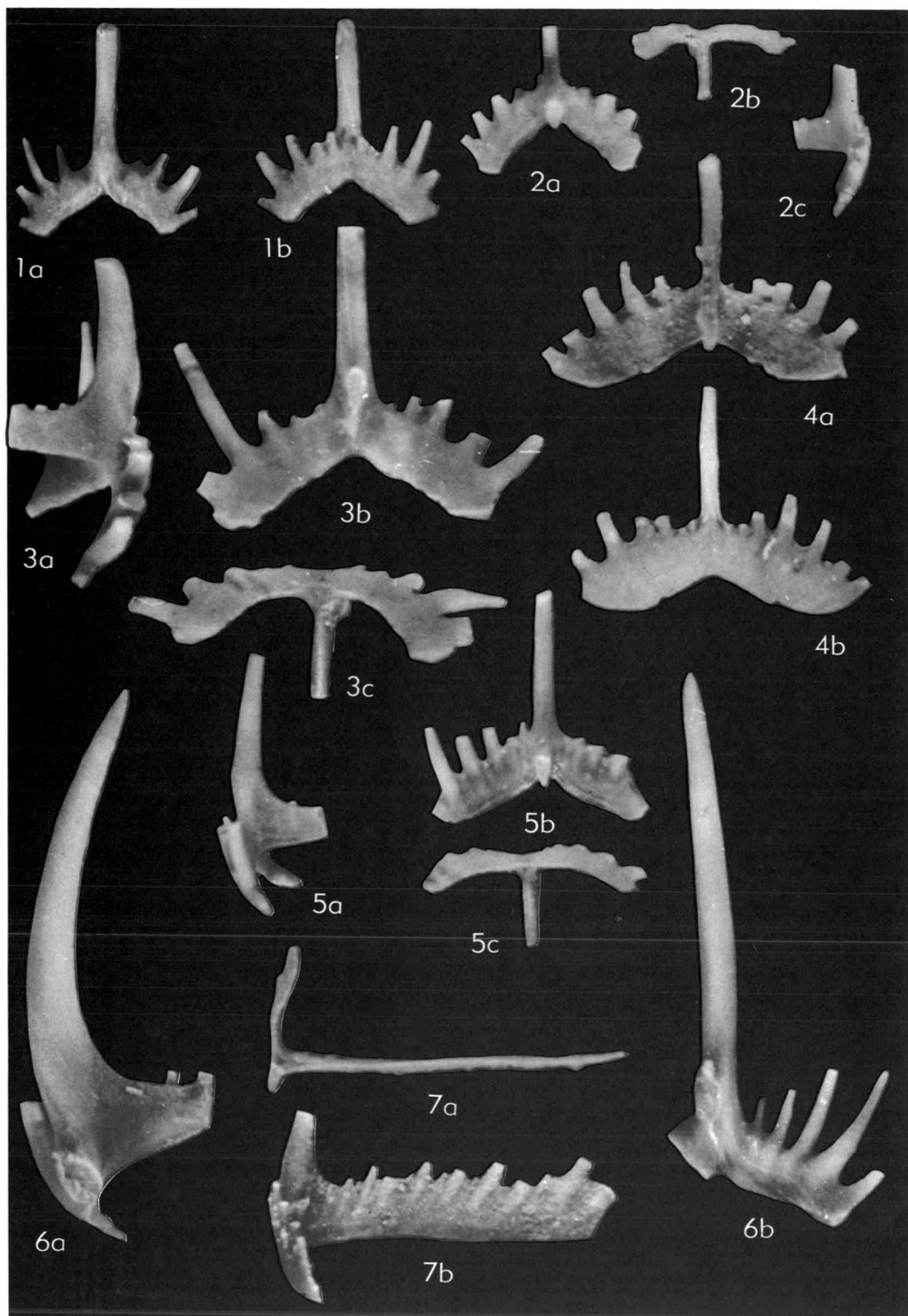


PLATE 10
All figures x50

Hindeodella acuta Branson & Mehl, 1934
(p. 25)

- 1 a—inner lateral view. b—oral view. CPC 15898 (WCB 007/19).
- 2 a—inner lateral view. b—oral view. CPC 15899 (WCB 007/36).
- 3 a—inner lateral view. b—oral view. CPC 15900 (WCB 017/69).

Hindeodella brevis Branson & Mehl, 1934
(p. 25)

- 4 a—inner lateral view. b—oral view. CPC 15901 (WCB 007/29).
- 5 a—aboral inner lateral view. b—outer lateral view. c—oral view. CPC 15902 (WCB 010/6).
- 6 a—inner lateral view. b—oral view. CPC 15903 (WCB 017/69).
- 7 oral view. CPC 15904 (WCB 201/8).

Hindeodella corpulenta Branson & Mehl, 1934
(p. 25)

- 8 inner lateral view. CPC 15905 (WCB 207/44).

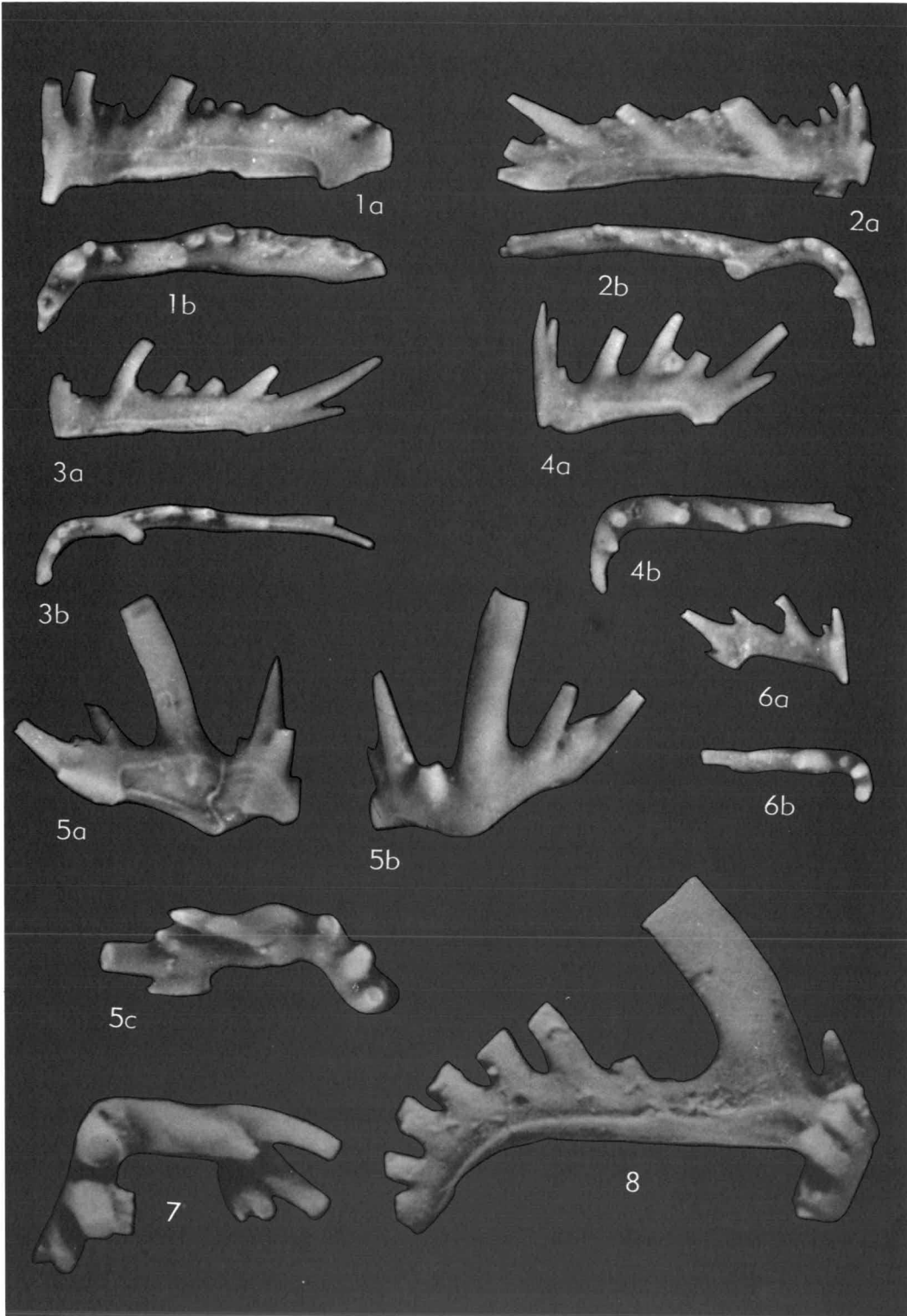


PLATE 11
All figures x50

Hindeodella sp. nov. B
(p. 26)

- 1 a—inner lateral view. b—oral view. CPC 15906 (WCB 017/50).
- 2 oral view. CPC 15907 (WCB 218/5).
- 3 oral view. CPC 15908 (WCB 010/4).
- 4 inner lateral view. CPC 15909 (WCB 207/44).

Hindeodella subtilis Bassler, 1925
(p. 25)

- 5 inner lateral view. CPC 15910 (WCB 012/2).
- 6 inner lateral view. CPC 15911 (WCB 014/16).
- 7 inner lateral view. CPC 15912 (WCB 202/3).

Hindeodella sp. nov. A
(p. 26)

- 8 inner lateral view. CPC 15913 (WCB 010/39).
- 9 inner lateral view. CPC 15914 (WCB 010/39).
- 10 inner lateral view. CPC 15915 (WCB 007/45).

Hindeodella corpulenta Branson & Mehl, 1934
(p. 25)

- 11 inner lateral view. CPC 15916 (WCB 010/39).
- 12 inner lateral view. CPC 15917 (WCB 017/16).
- 13 inner lateral view. CPC 15918 (WCB 202/18).

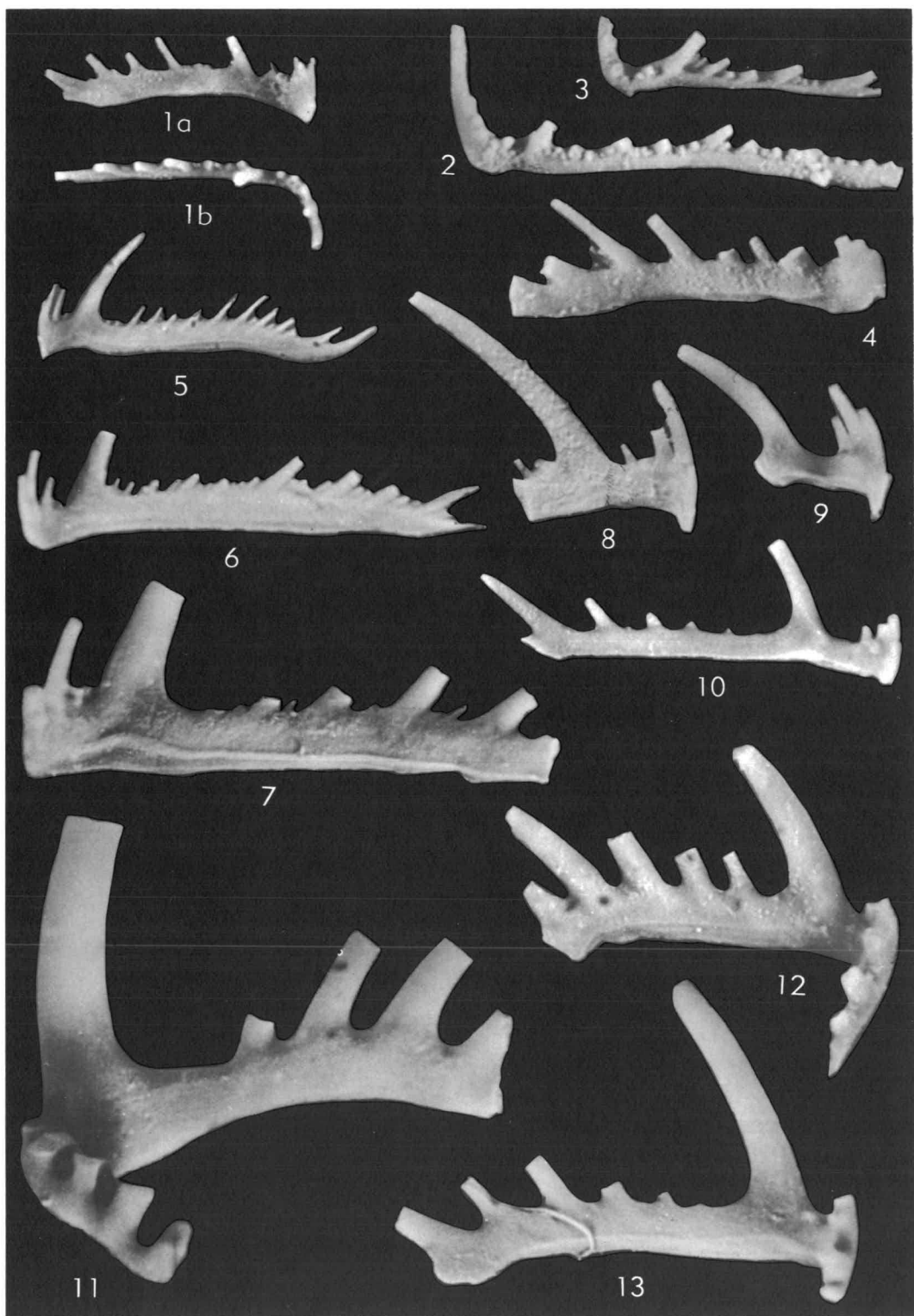


PLATE 12
All figures x50

Icriodus platys (S_1 element) sp. nov.
(p. 17)

- 1 a—left lateral view. b—right lateral view. c—aboral view. d—oral view.
CPC 15919 (WCB 002/12).
- 2 a—left lateral view. b—right lateral view. c—aboral view. d—oral view.
CPC 15920 (WCB 002/12).

Icriodus platys (I element) sp. nov.
(p. 17)

- 3 a—oral view. b—aboral view. CPC 15921 (WCB 218/5 Paratype.
- 4 a—oral view. b—aboral view. CPC 15922 (WCB 218/5) **Holotype**.
- 5 a—oral view. b—aboral view. CPC 15923 (WCB 001/9) Paratype.
- 7 a—aboral view. b—oral view. CPC 15924 (WCB 002/6) Paratype.

Ligonodina platys Cooper, 1939
(p. 26)

- 6 a—outer lateral view. b—inner lateral view. CPC 15925 (WCB 102/10).

Neoprioniodus cf. **N. alatoideus** (Cooper, 1939)
(p. 26)

- 8 inner lateral view. CPC 15926 (WCB 007/30).
- 9 inner lateral view. CPC 15927 (WCB 007/30).

Neoprioniodus alatus (Hinde, 1879)
(p. 26)

- 10 inner lateral view. CPC 15928 (WCB 017/69).
- 11 inner lateral view. CPC 15929 (WCB 007/38).
- 12 inner lateral view. CPC 15930 (WCB 103/49).
- 13 a—inner lateral view. b—aboral view. CPC 15931 (WCB 102/10).

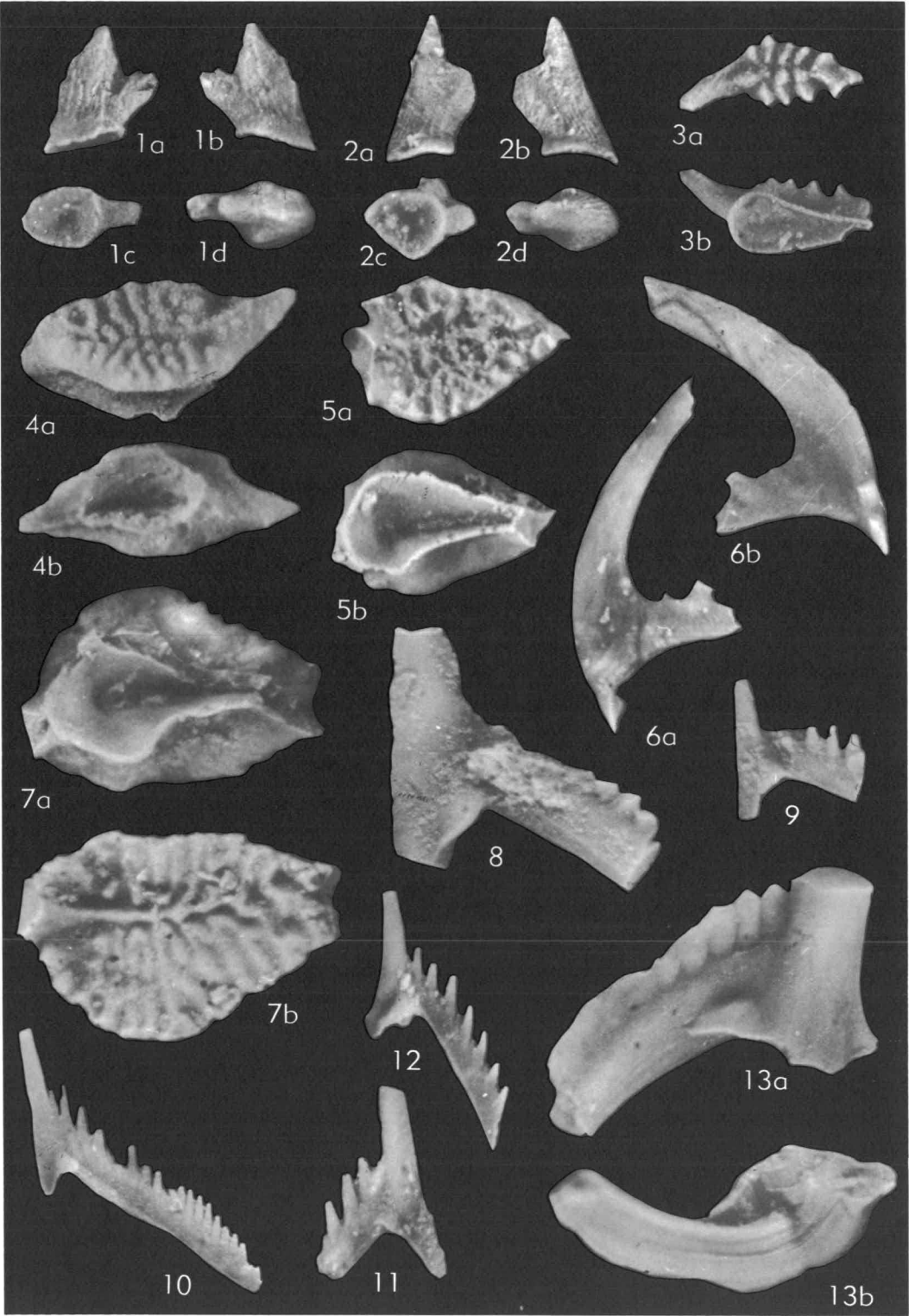


PLATE 13
All figures x50

Neoprioniodus sp. nov. A
(p. 27)

- 1 inner lateral view. CPC 15932 (WCB 007/40).
- 2 inner lateral view. CPC 15933 (WCB 007/40).

Neoprioniodus barbatus (Branson & Mehl, 1934)
(p. 27)

- 3 inner lateral view. CPC 15934 (WCB 102/6).
- 4 outer lateral view. CPC 15935 (WCB 102/10).
- 5 inner lateral view. CPC 15936 (WCB 102/10).

Ozarkodina abnormis Branson & Mehl, 1934
(p. 27)

- 6 a—right lateral view. b—left lateral view. CPC 15937 (WCB 019/1).
- 7 a—right lateral view. b—left lateral view. CPC 15938 (WCB 207/11).
- 8 a—right lateral view. b—left lateral view. CPC 15939 (WCB 010/4).

Ozarkodina flexa (Branson & Mehl, 1934)
(p. 27)

- 9 a—right lateral view. b—left lateral view. CPC 15940 (WCB 007/30).

Ozarkodina cf. **O. plana** (Branson & Mehl, 1934)
(p. 27)

- 10 a—right lateral view. b—left lateral view. CPC 15941 (WCB 017/49).
- 11 right lateral view. CPC 15942 (WCB 102/10).
- 12 right lateral view. CPC 15943 (WCB 007/41).
- 13 a—right lateral view. b—left lateral view. CPC 15944 (WCB 103/88).

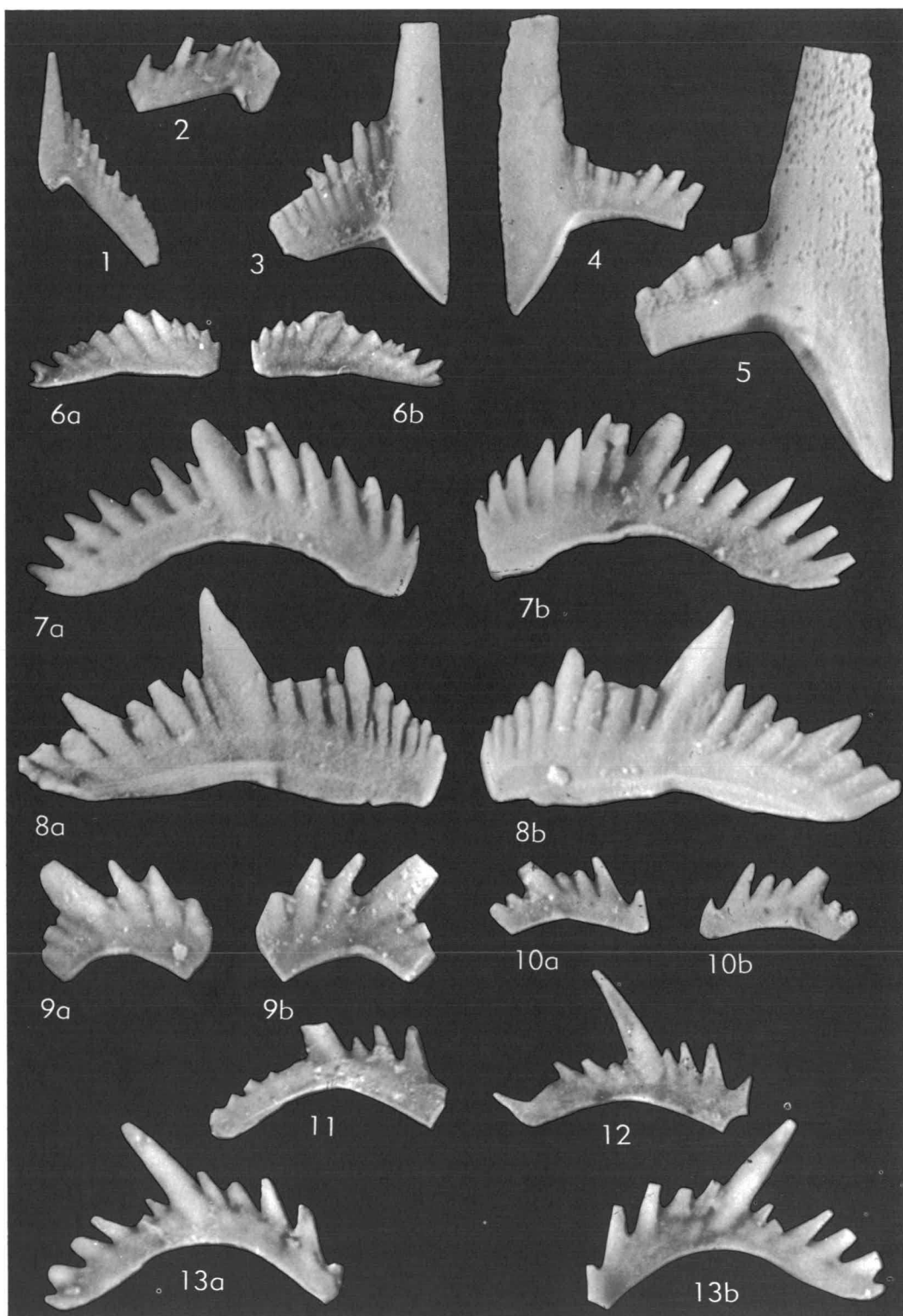


PLATE 14
All figures x50

Ozarkodina rhenana Bischoff & Ziegler, 1956
(p. 27)

- 1 left lateral view. CPC 15945 (WCB 007/6).
- 2 right lateral view. CPC 15946 (WCB 007/17).
- 3 a—right lateral view. b—left lateral view. CPC 15947 (WCB 011/1).
- 4 left lateral view. CPC 15948 (WCB 007/26).
- 5 a—right lateral view. b—left lateral view. CPC 15949 (WCB 007/17).
- 6 a—right lateral view. b—left lateral view. CPC 15950 (WCB 013/36).
- 7 right lateral view. CPC 15951 (WCB 017/49).
- 8 left lateral view. CPC 15952 (WCB 007/17).
- 9 right lateral view. CPC 15953 (WCB 017/67).
- 10 a—right lateral view. b—left lateral view. CPC 15954 (WCB 007/29).

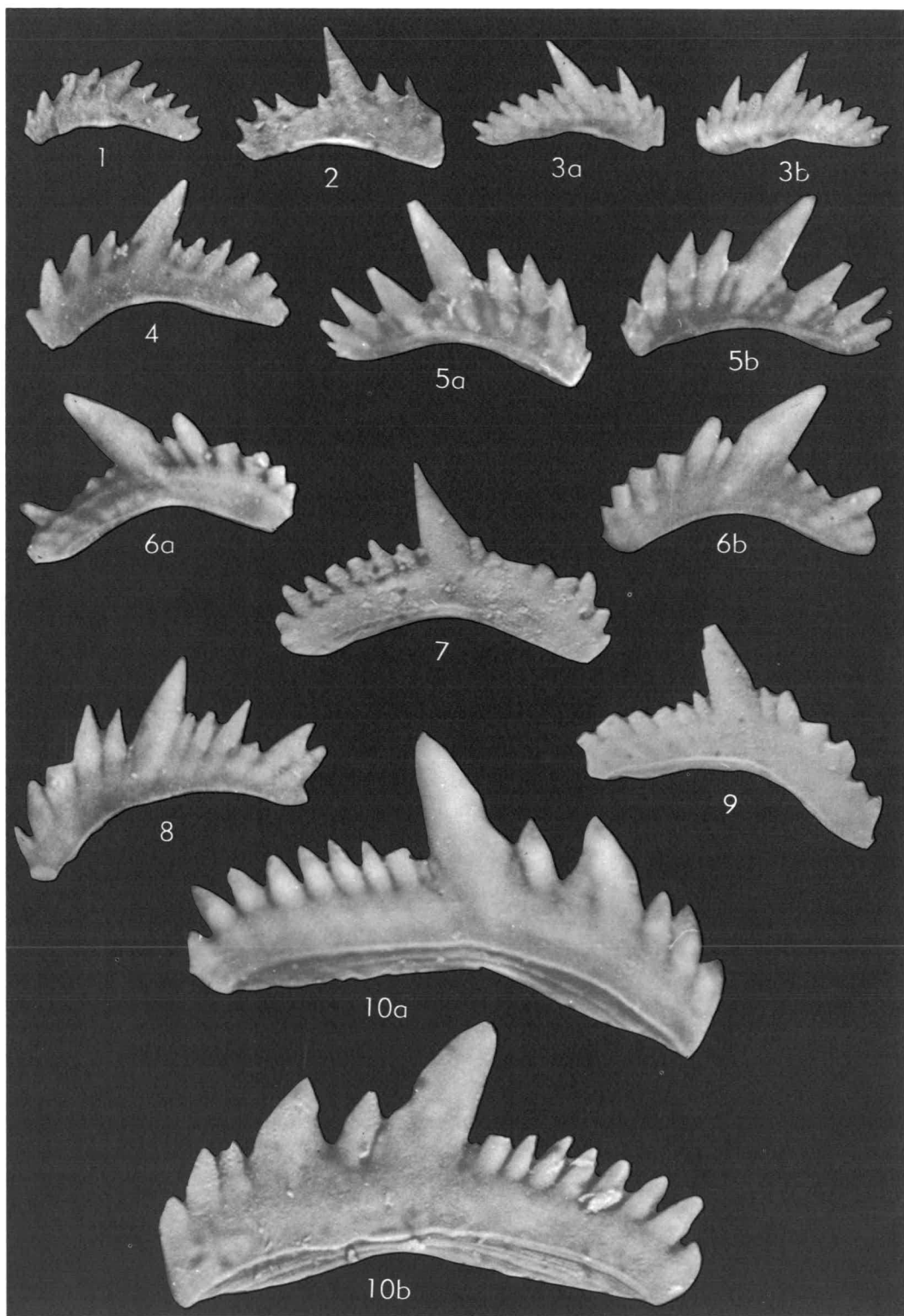


PLATE 15
All figures x50

Polygnathus communis communis Branson Mehl, 1934
(p. 29)

- 1 a—oral view. b—aboral view. CPC 15955 (WCB 102/10).

Polygnathus burtensis (Druce, 1969)
(p. 28)

- 2 a—left lateral view. b—oral view. c—aboral view. CPC 15956 (WCB 103/76).

Patrognathus sp. A
(p. 28)

- 3 a—right lateral view. b—left lateral view. c—aboral view. d—oral view. CPC 15957 (Lennard River 1/10).
4 a—right lateral view. b—left lateral view. c—aboral view. d—oral view. CPC 15958 (Lennard River 1/11).

Ozarkodina sp. A
(p. 28)

- 5 a—right lateral view. b—left lateral view. CPC 15959 (WCB 007/40).

Ozarkodina cf. **O. plana** (Branson & Mehl, 1934)
(p. 27)

- 6 a—left lateral view. b—right lateral view. CPC 15960 (WCB 017/62).
7 right lateral view. CPC 15961 (WCB 103/59).

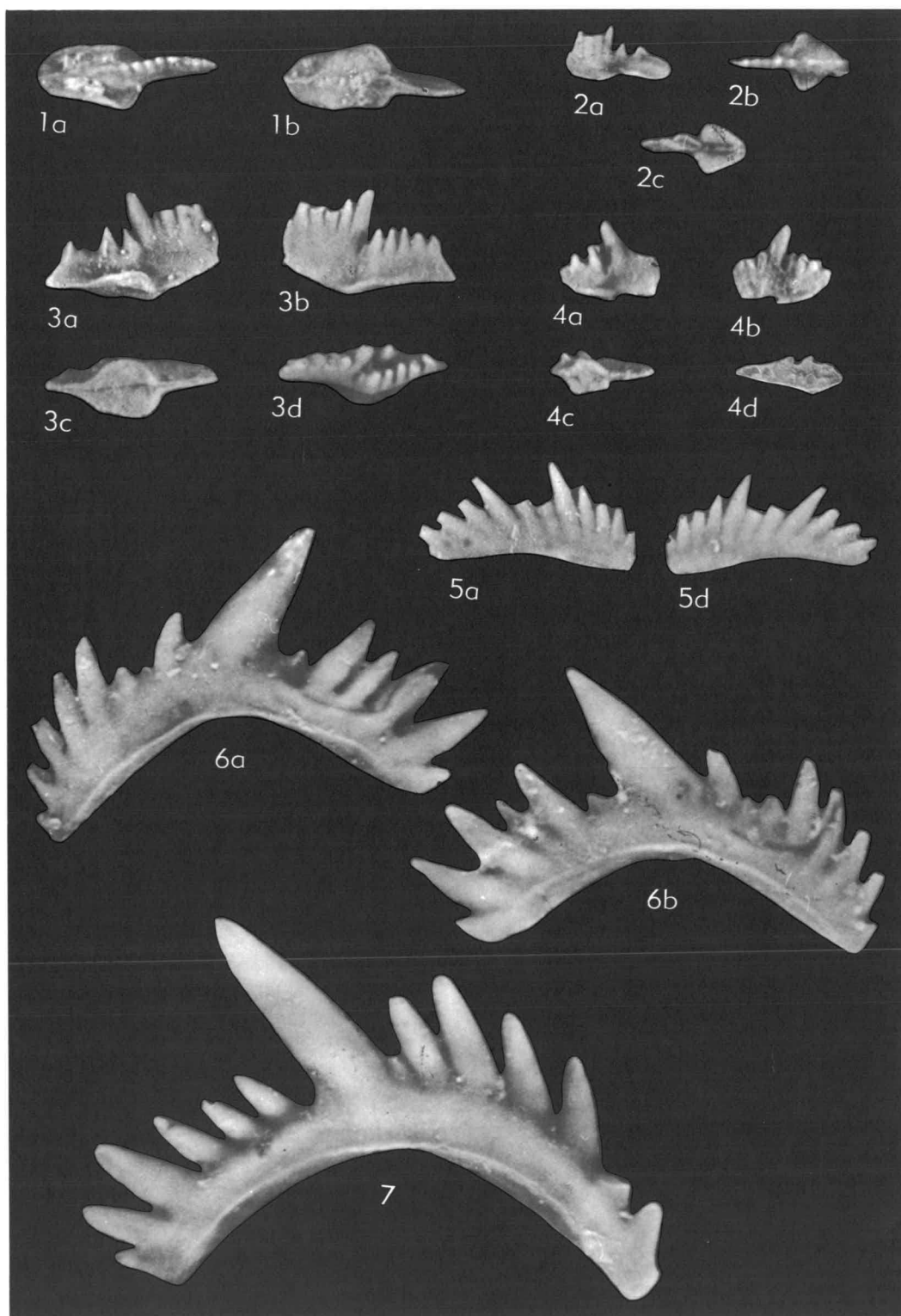


PLATE 16
All figures x50

Polygnathus communis collinsoni Druce, 1969
(p. 28)

- 1 a—oral view. b—aboral view. CPC 15962 (WCB 019/2).
- 2 a—oral view. b—aboral view. CPC 15963 (WCB 019/2).
- 3 a—oral view. b—aboral view. CPC 15964 (WCB 019/2).
- 4 a—oral view. b—aboral view. CPC 15965 (WCB 019/2).
- 5 a—oral view. b—aboral view. CPC 15966 (WCB 019/2).
- 6 a—oral view. b—aboral view. CPC 15967 (WCB 019/2).

Polygnathus inornatus E. R. Branson, 1934
(p. 29)

- 7 a—left lateral view. b—oral view. c—aboral view. CPC 15968 (WCB 007/3).
- 8 a—right lateral view. b—oral view. c—aboral view. CPC 15969 (WCB 102/10).
- 9 a—right lateral view. b—oral view. c—aboral view. CPC 15970 (WCB 102/10).

Polygnathus aff. **P. lacinatus** sensu Rhodes, Austin & Druce, 1969
(p. 29)

- 10 a—oral view. b—aboral view. c—left lateral view. CPC 15971 (WCB 212/8).

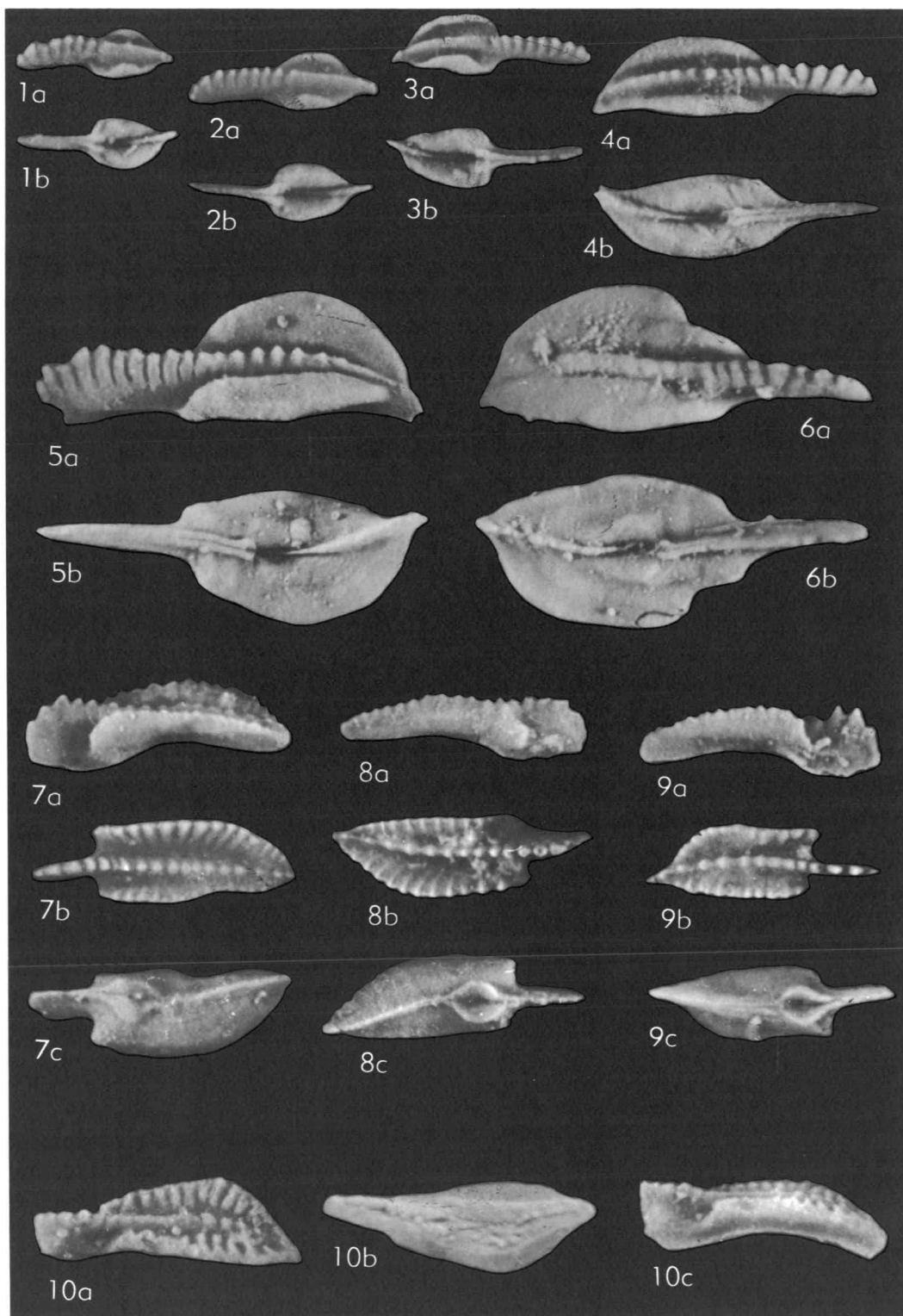


PLATE 17
All figures x50

Polygnathus spp.
(p. 29)

- 1 a—left lateral view. b—oral view. c—aboral view. CPC 15972 (WCB 017/5).
- 2 a—left lateral view. b—oral view. c—aboral view. CPC 15973 (WCB 011/2).

?Polygnathus sp. A
(p. 29)

- 3 a—right lateral view. b—left lateral view. c—aboral view. d—oral view. CPC 15974 (WCB 004/8).
- 4 a—right lateral view. b—left lateral view. c—aboral view. d—oral view. CPC 15975 (WCB 005/1).
- 5 a—right lateral view. b—left lateral view. c—aboral view. d—oral view. CPC 15976 (Noonkanbah 4/9).

Polygnathus thomasi Druce, 1969
(p. 29)

- 6 a—left lateral view. b—oral view. c—aboral view. CPC 15977 (WCB 007/13).
- 7 a—oral view. b—left lateral view. c—aboral view. CPC 15978 (WCB 013/39).

Prioniodina? symmetrica Branson & Mehl, 1934
(p. 30)

- 8 inner lateral view. CPC 15979 (WCB 007/38).
- 9 inner lateral view. CPC 15980 (WCB 207/36).
- 10 inner lateral view. CPC 15981 (WCB 101/53).
- 11 inner lateral view. CPC 15982 (WCB 202/27).

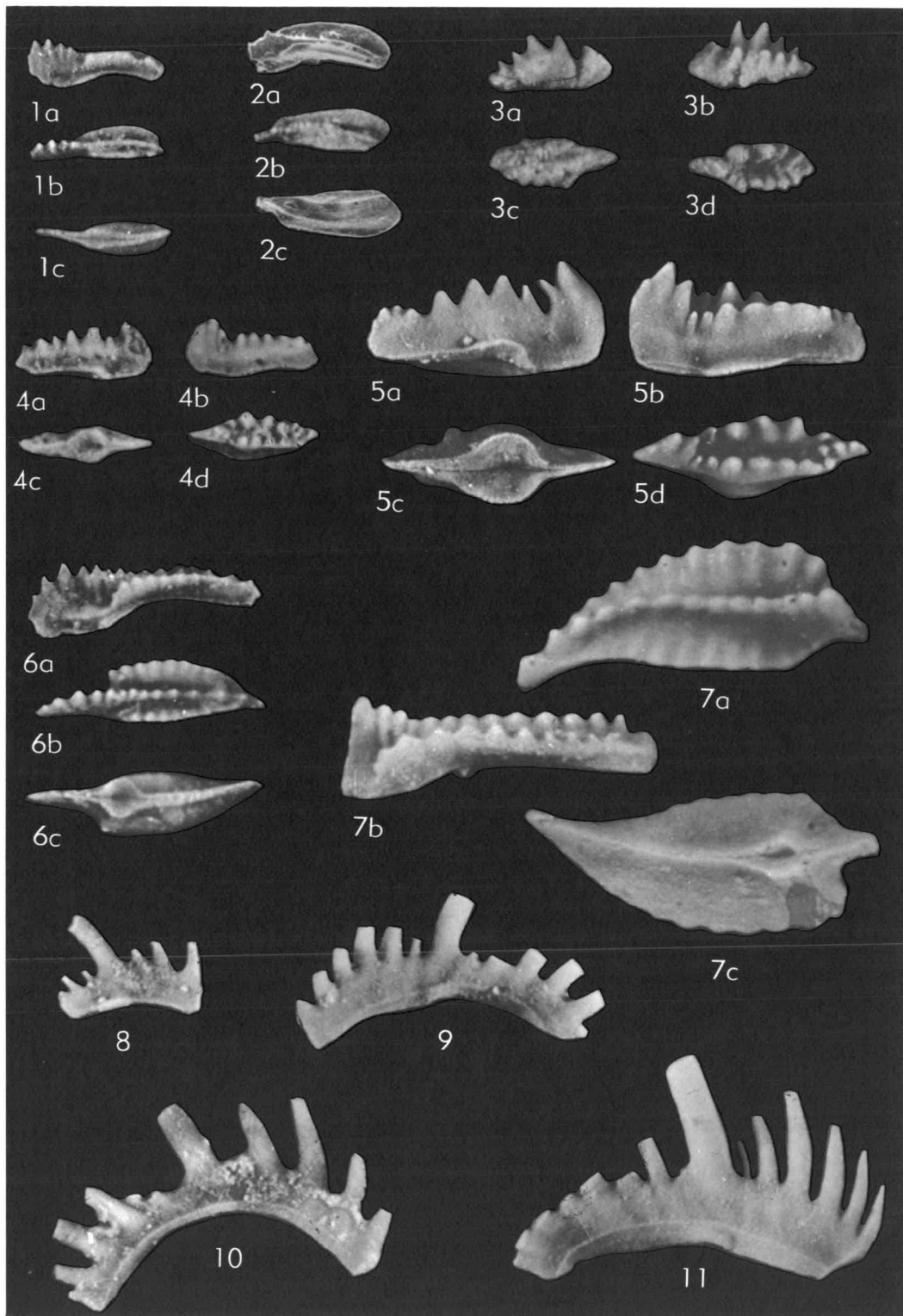


PLATE 18
All figures x50

Pseudopolygnathus cf. *Ps. dentilineatus* E. R. Branson, 1934
(p. 30)

- | | | | | |
|---|----------------------|----------------------|----------------|-------------------------|
| 1 | a—oral view. | b—left lateral view. | c—aboral view. | CPC 15983 (WCB 103/87). |
| 2 | a—oral view. | b—left lateral view. | c—aboral view. | CPC 15984 (WCB 103/73). |
| 3 | a—oral view. | b—left lateral view. | c—aboral view. | CPC 15985 (WCB 103/73). |
| 4 | a—oral view. | b—left lateral view. | c—aboral view. | CPC 15986 WCB 103/87). |
| 5 | a—oral view. | b—left lateral view. | c—aboral view. | CPC 15987 (WCB 103/73). |
| 6 | a—left lateral view. | b—oral view. | c—aboral view. | CPC 15988 (WCB 103/87). |

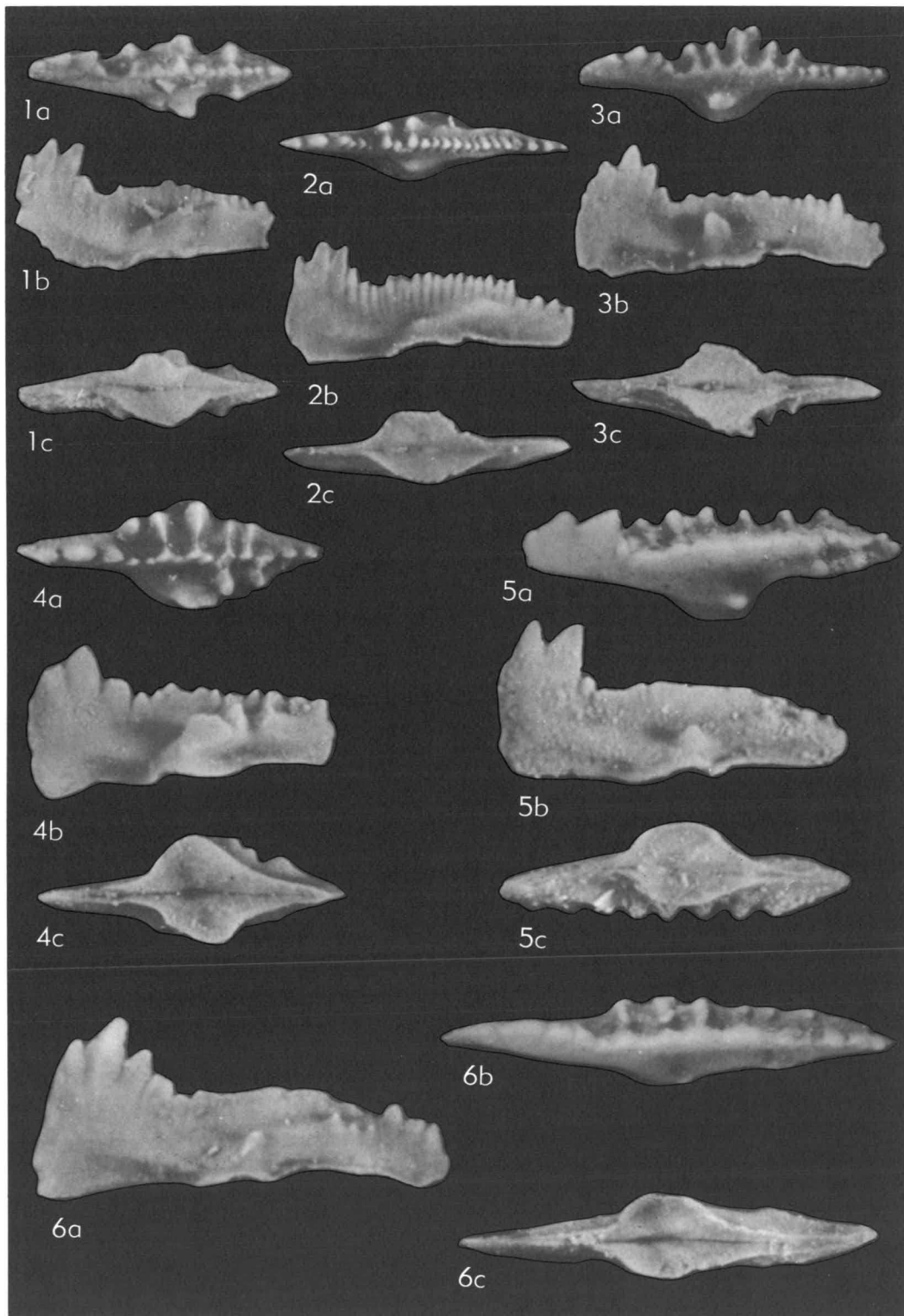


PLATE 19
All figures x50

Pseudopolygnathus multistriatus Mehl & Thomas, 1947
(p. 30)

- 1 a—right lateral view. b—aboral view. c—left lateral view. d—oral view.
CPC 15989 (WCB 101/33).
- 2 a—right lateral view. b—aboral view. c—left lateral view. d—oral view.
CPC 15990 (WCB 007/31).
- 3 a—right lateral view. b—aboral view. c—left lateral view. d—oral view.
CPC 15991 (WCB 101/33).
- 4 a—right lateral view. b—aboral view. c—left lateral view. d—oral view.
CPC 15992 (WCB 101/33).
- 5 a—left lateral view. b—aboral view. c—right lateral view. d—oral view.
CPC 15993 (WCB 017/53).
- 6 a—right lateral view. b—aboral view. c—left lateral view. d—oral view.
CPC 15994 (WCB 017/53).

Pseudopolygnathus cf. Ps. nodomarginatus (E. R. Branson, 1934)
(p. 30)

- 7 a—right lateral view. b—left lateral view. c—aboral view. d—oral view.
CPC 15995 (WCB 017/62).

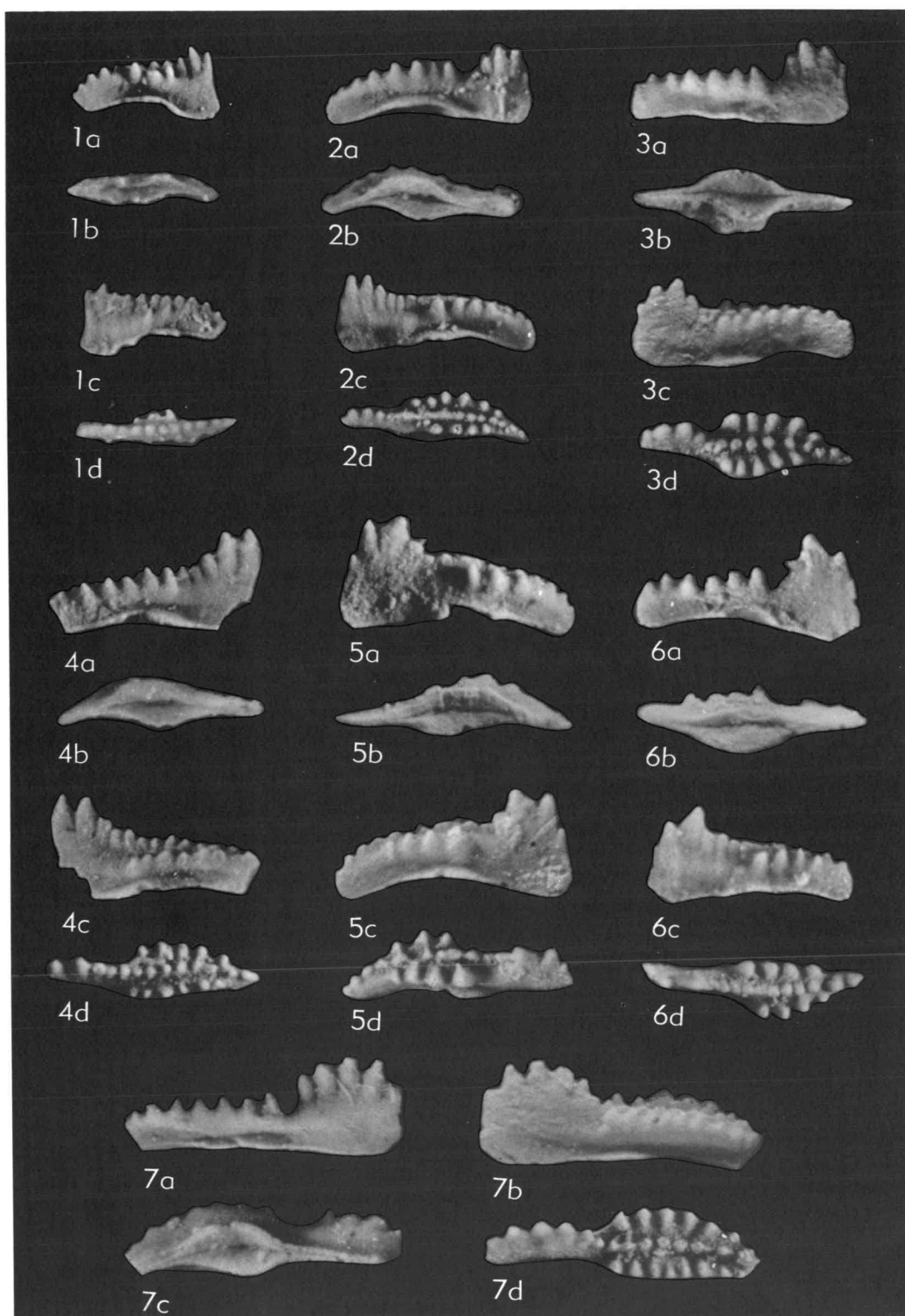


PLATE 20
All figures x50

Siphonodella cf. S. cooperi hassi Thompson & Fellows, 1970
(p. 30)

- 1 a—left lateral view. b—oral view. c—aboral view. CPC 15996 (WCB 012/2).

Siphonodella spp.
(p. 30)

- 2 oral view. CPC 15997 (WCB 212/13).

Spathognathodus acidentatus (E. R. Branson, 1934)
(p. 30)

- 3 a—right lateral view. b—aboral view. CPC 15998 (WCB 212/1).
4 right lateral view. CPC 15999 (WCB 202/3).
5 right lateral view. CPC 16000 (WCB 201/4).
6 right lateral view. CPC 16001 (WCB 202/27).
7 right lateral view. CPC 16002 (WCB 218/5).
8 a—left lateral view. b—aboral view. CPC 16003 (WCB 001/9).
9 right lateral view. CPC 16004 (WCB 001/9).

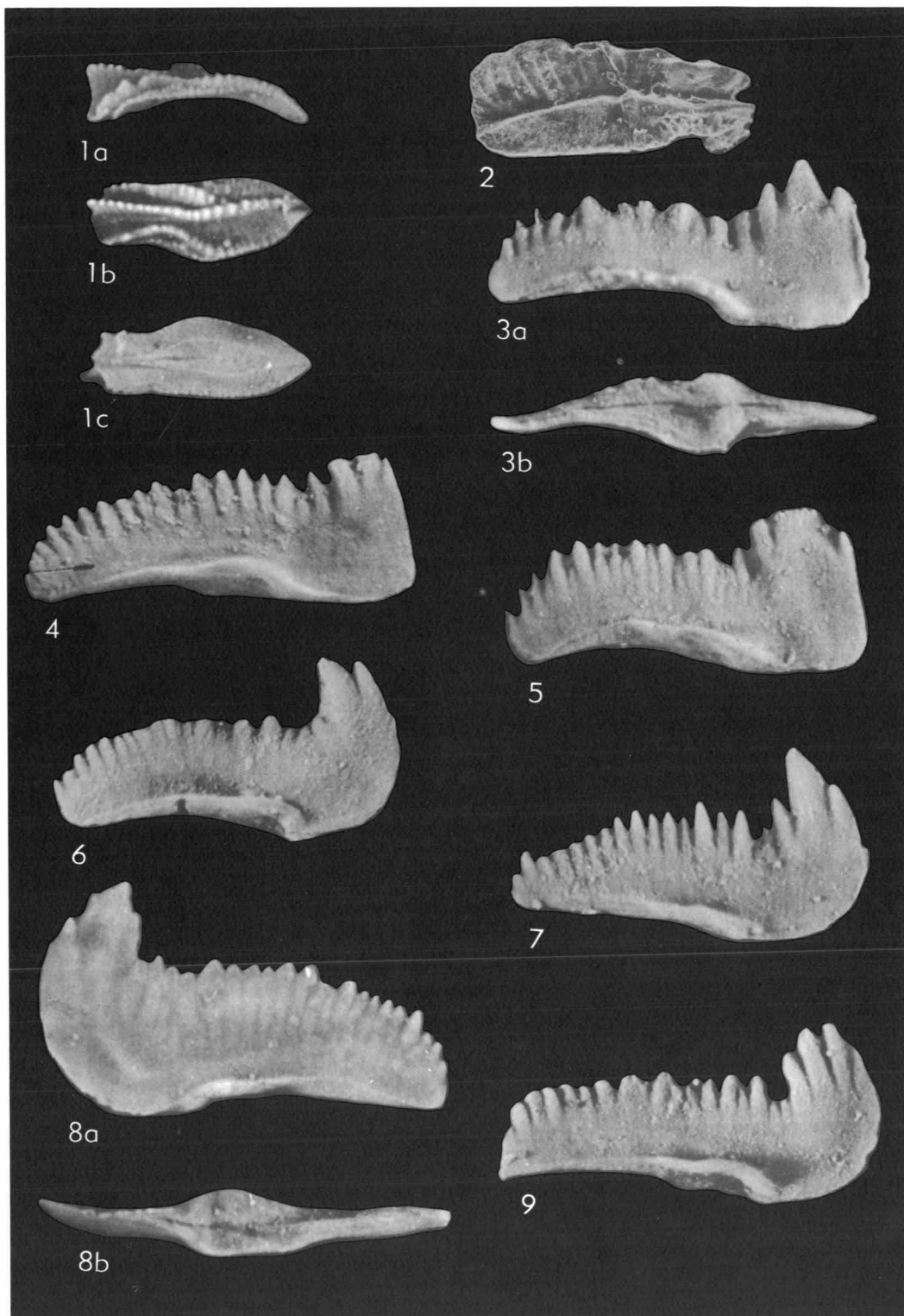


PLATE 21
All figures x50

Spathognathodus aciendentatus (E. R. Branson, 1934)
(p. 30)

- 1 right lateral view. CPC 16005 (WCB 002/1).
- 2 right lateral view. CPC 16006 (WCB 002/10).
- 3 right lateral view. CPC 16007 (WCB 002/9).
- 4 a—right lateral view. b—aboral view. CPC 16008 (WCB 202/24).
- 5 a—right lateral view. b—oral view. CPC 16009 (WCB 002/6).
- 6 a—left lateral view. b—oral view. CPC 16010 (WCB 206/26).

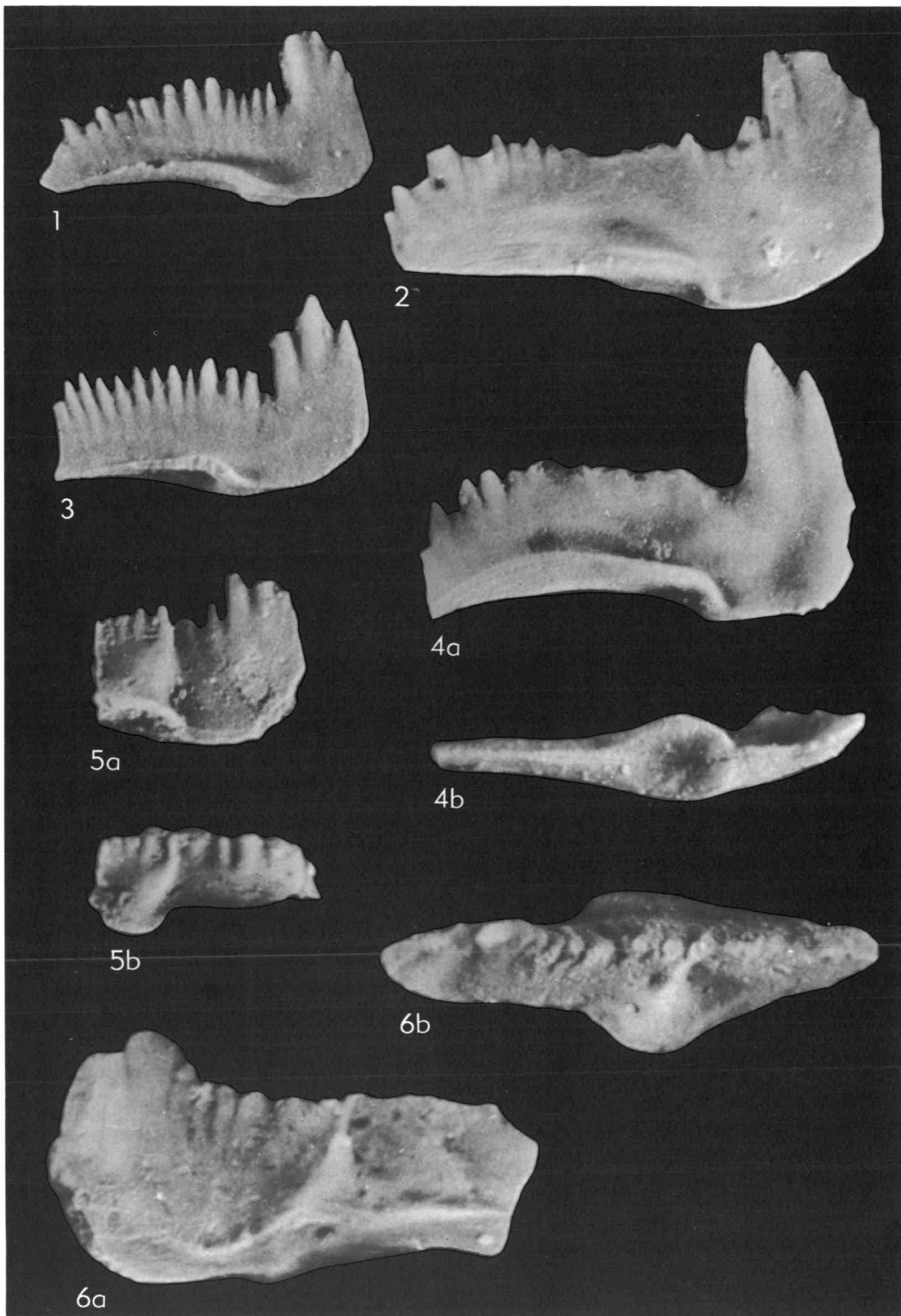


PLATE 22
All figures x50

Spathognathodus canningensis sp. nov.
(p. 31)

- 1 a—right lateral view. b—aboral view. c—oral view. CPC 16011 (WCB 103/76 Paratype.
- 2 a—right lateral view. b—aboral view. c—oral view. CPC 16012 (WCB 103/76) **Holotype.**
- 3 a—right lateral view. b—aboral view. c—oral view. CPC 16013 (WCB 103/60) Paratype.
- 4 a—right lateral view. b—oral view. c—aboral view. CPC 16014 (WCB 102/10) Paratype.
- 5 a—left lateral view. b—oral view. c—aboral view. CPC 16015 (WCB 017/15) Paratype.

Bispathodus aculeatus aculeatus (Branson & Mehl, 1934)
(p. 21)

- 6 a—left lateral view. b—oral view. c—aboral view. CPC 16016 (WCB 103/63).
- 7 a—right lateral view. b—left lateral view. c—aboral view. d—oral view. CPC 16017 (WCB 103/23).

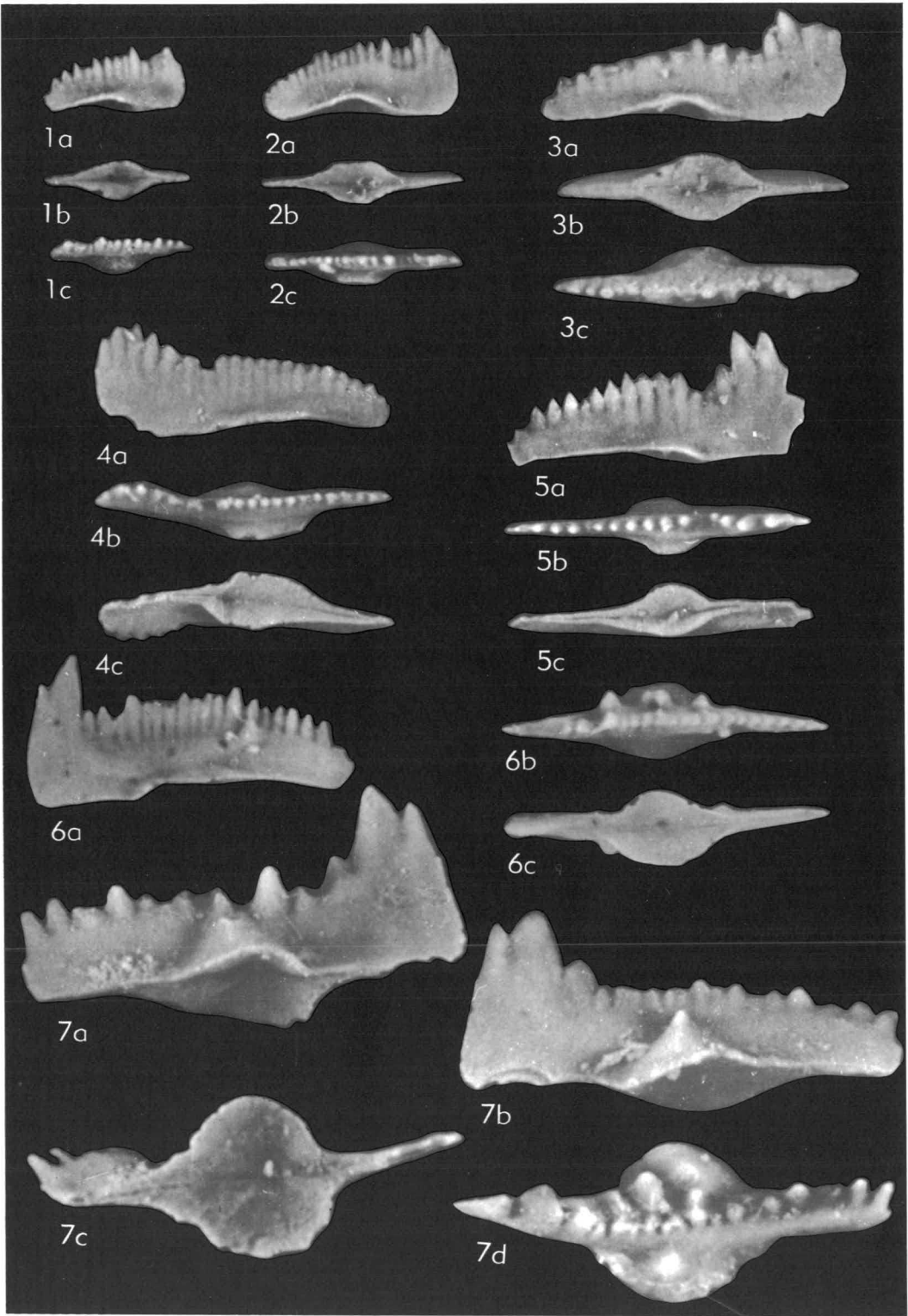


PLATE 23
All figures x50

Spathognathodus crassidentatus (Branson & Mehl, 1934)
(p. 31)

- 1 a—right lateral view. b—aboral view. CPC 16018 (WCB 007/26).
- 2 a—left lateral view. b—aboral view. CPC 16019 (WCB 102/12).
- 3 a—right lateral view. b—aboral view. CPC 16020 (WCB 207/8).
- 4 a—right lateral view. b—aboral view. CPC 16021 (WCB 017/42).
- 5 a—right lateral view. b—aboral view. CPC 16022 (WCB 222/9).

Spathognathodus mehlbrai sp. nov.
(p. 32)

- 6 a—right lateral view. b—aboral view. CPC 16023 (WCB 019/2) Paratype.
- 7 a—right lateral view. b—aboral view. CPC 16024 (WCB 019/3) **Holotype.**
- 8 a—right lateral view. b—aboral view. CPC 16025 (WCB 002/14A) Paratype.
- 9 right lateral view. CPC 16026 (WCB 212/0) Paratype.

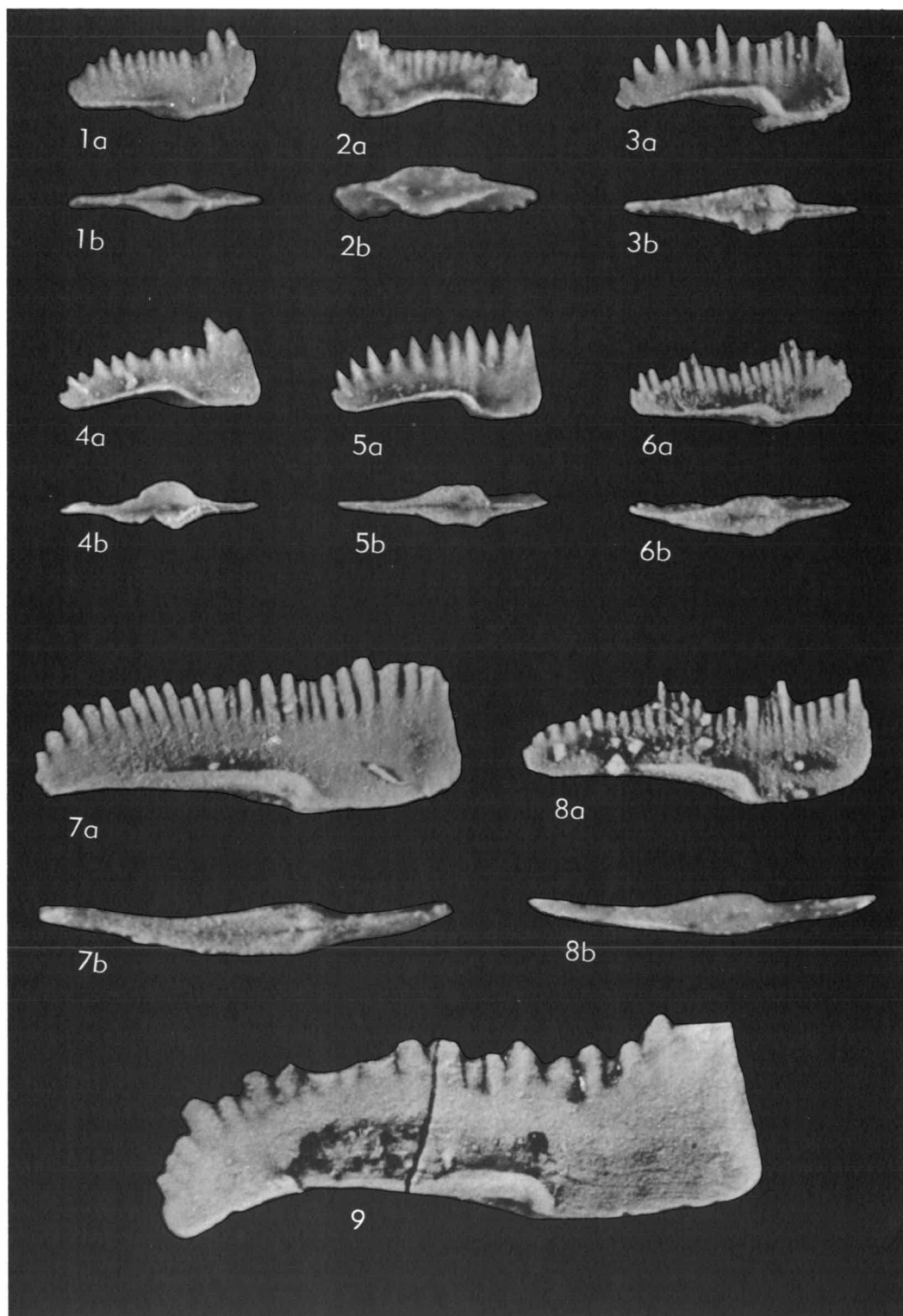


PLATE 24
All figures x50

Bispathodus aculeatus plumulus (Rhodes, Austin & Druce, 1969)
(p. 21)

- 1 a—right lateral view. b—left lateral view. c—aboral view. d—oral view.
CPC 16027 (WCB 007/4).
- 2 a—right lateral view. b—left lateral view. c—aboral view. d—oral view.
CPC 16028 (WCB 007/4).
- 3 a—right lateral view. b—left lateral view. c—oral view. d—aboral view.
CPC 16029 (WCB 007/15).
- 4 a—right lateral view. b—left lateral view. c—oral view. d—aboral view.
CPC 16030 (WCB 007/3).
- 5 a—right lateral view. b—left lateral view. c—oral view. d—aboral view.
CPC 16031 (WCB 007/41).
- 6 a—right lateral view. b—left lateral view. c—aboral view. d—oral view.
CPC 16032 (WCB 007/1).

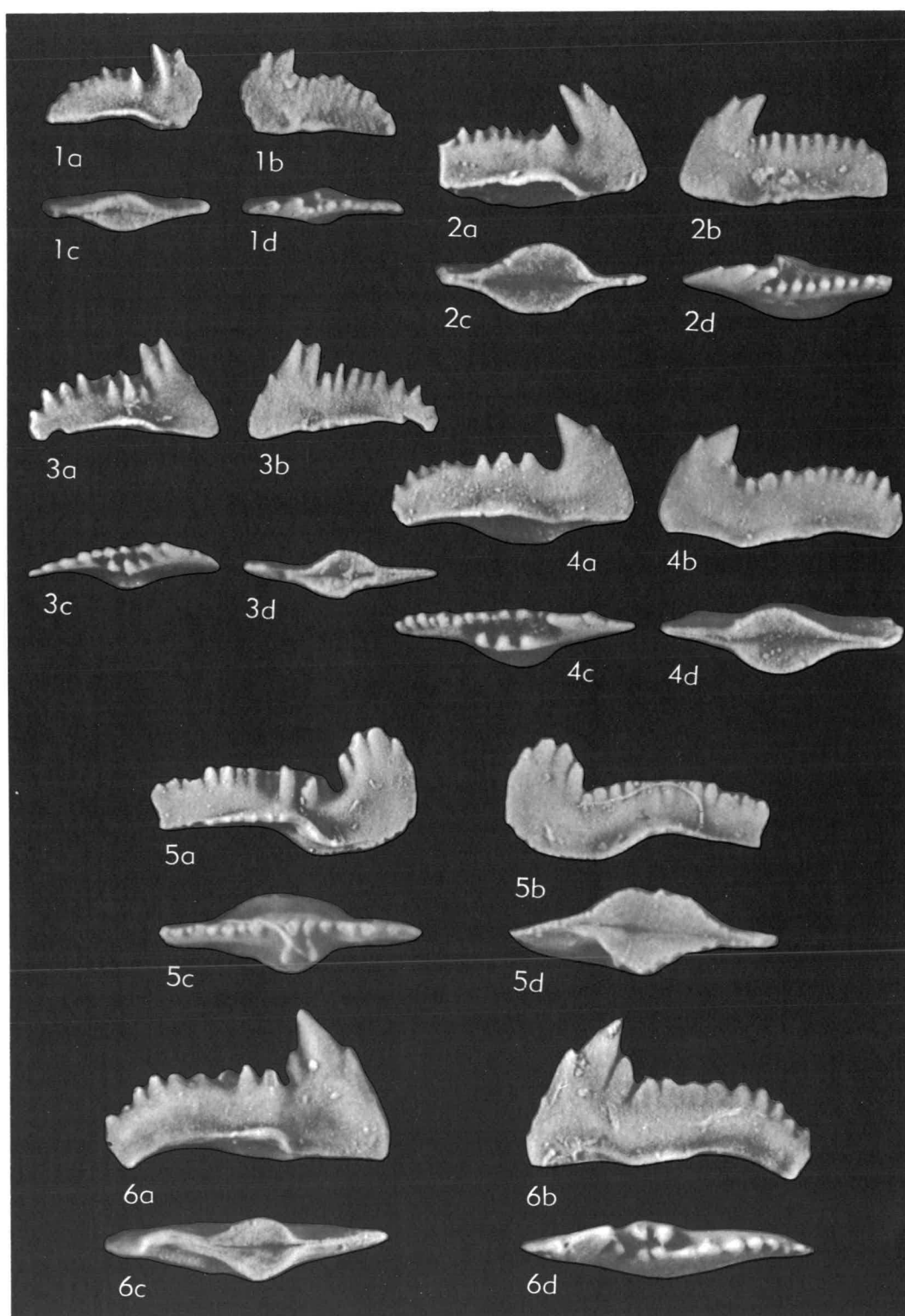


PLATE 25
All figures x50

Spathognathodus cf. **S. robustus** (Branson & Mehl, 1934)
(p. 32)

- 1 a—oral view. b—right lateral view. c—aboral view. CPC 16033 (WCB 103/23).
- 2 a—aboral view. b—right lateral view. c—left lateral view. d—oral view. CPC 16034 (WCB 007/17).
- 3 a—oral view. b—right lateral view. c—aboral view. CPC 16035 (WCB 103/87).
- 4 a—left lateral view. b—oral view. c—aboral view. CPC 16036 (WCB 007/38).
- 5 a—left lateral view. b—oral view. c—aboral view. CPC 16037 (WCB 017/67).
- 6 a—right lateral view. b—left lateral view. c—aboral view. d—oral view. CPC 16038 (WCB 007/40).

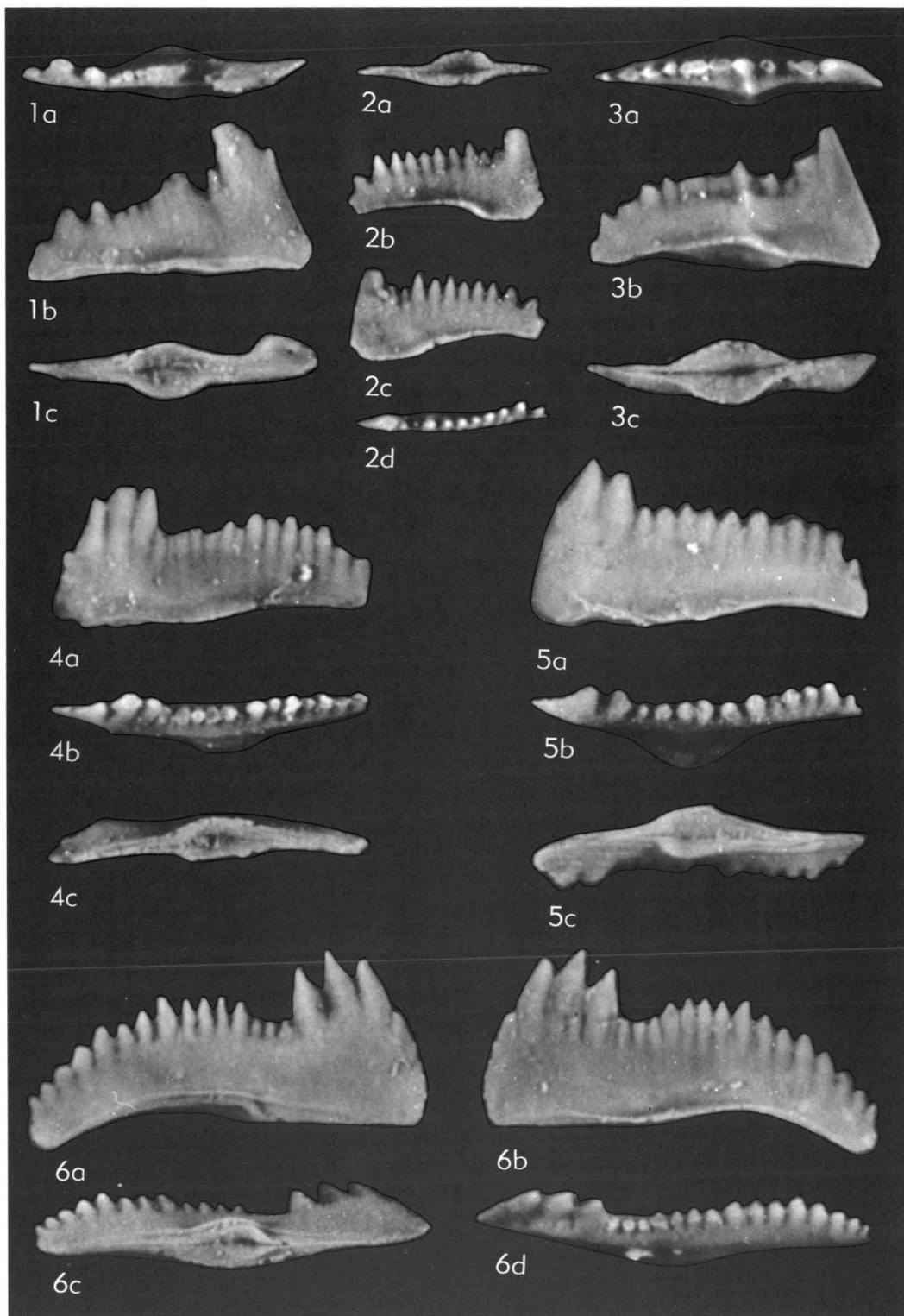


PLATE 26
All figures x50

Bispathodus spinulicostatus (E. R. Branson, 1934)
(p. 22)

- 1 oral view. CPC 16039 (WCB 103/53).
- 2 oral view. CPC 16040 (WCB 103/23).
- 3 a—oral view. b—right lateral view. CPC 16041 (WCB 103/23).
- 4 a—right lateral view. b—aboral view. c—oral view. d—left lateral view.
CPC 16042 (WCB 103/53).
- 5 a—left lateral view. b—oral view. c—aboral view. d—right lateral view.
CPC 16043 (WCB 103/1).

Bispathodus ziegleri (Rhodes, Austin & Druce, 1969)
(p. 22)

- 6 a—left lateral view. b—oral view. c—aboral view. CPC 16044 (WCB 002/1).

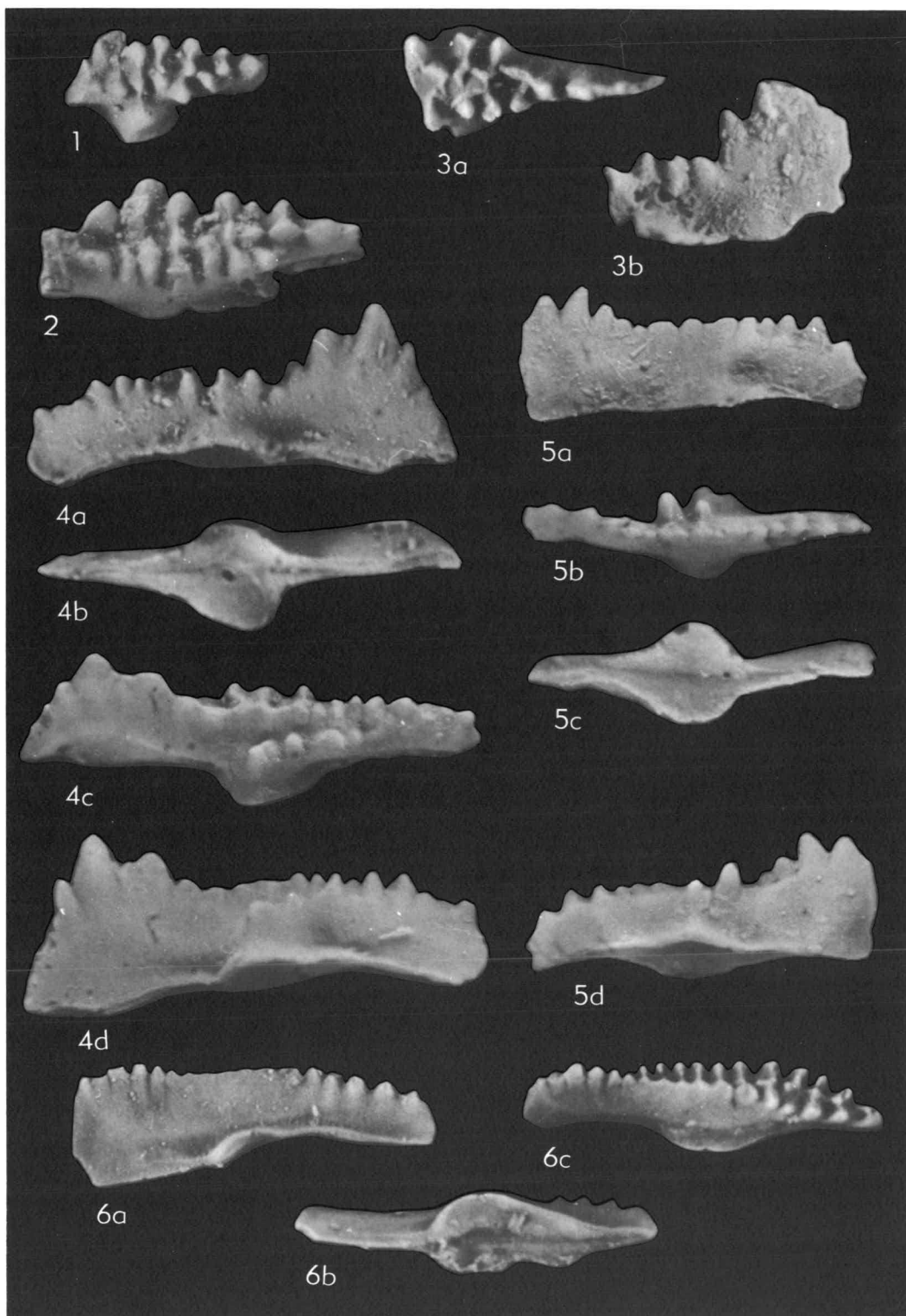


PLATE 27
All figures x50

Spathognathodus? sp. nov. A
(p. 33)

- 1 a—right lateral view. b—aboral view. c—left lateral view. d—oral view.
CPC 16045 (WCB 218/1).
- 2 a—right lateral view. b—aboral view. c—left lateral view. d—oral view.
CPC 16046 (WCB 218/1).
- 3 a—right lateral view. b—aboral view. c—left lateral view. d—oral view.
CPC 16047 (WCB 218/1).
- 4 a—right lateral view. b—aboral view. c—left lateral view. d—oral view.
CPC 16048 (WCB 218/1).
- 5 a—right lateral view. b—aboral view. c—left lateral view. d—oral view.
CPC 16049 (WCB 218/1).

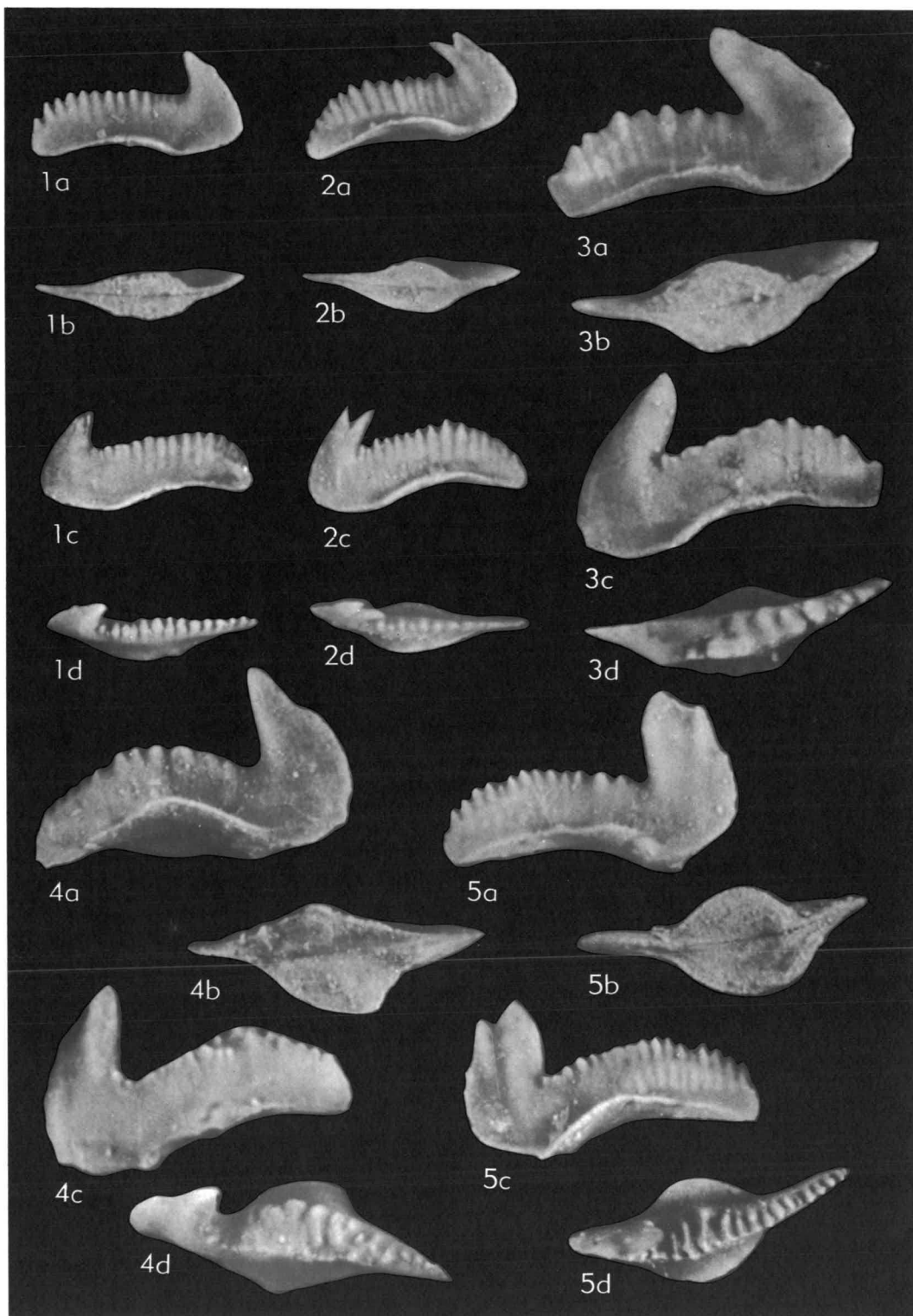


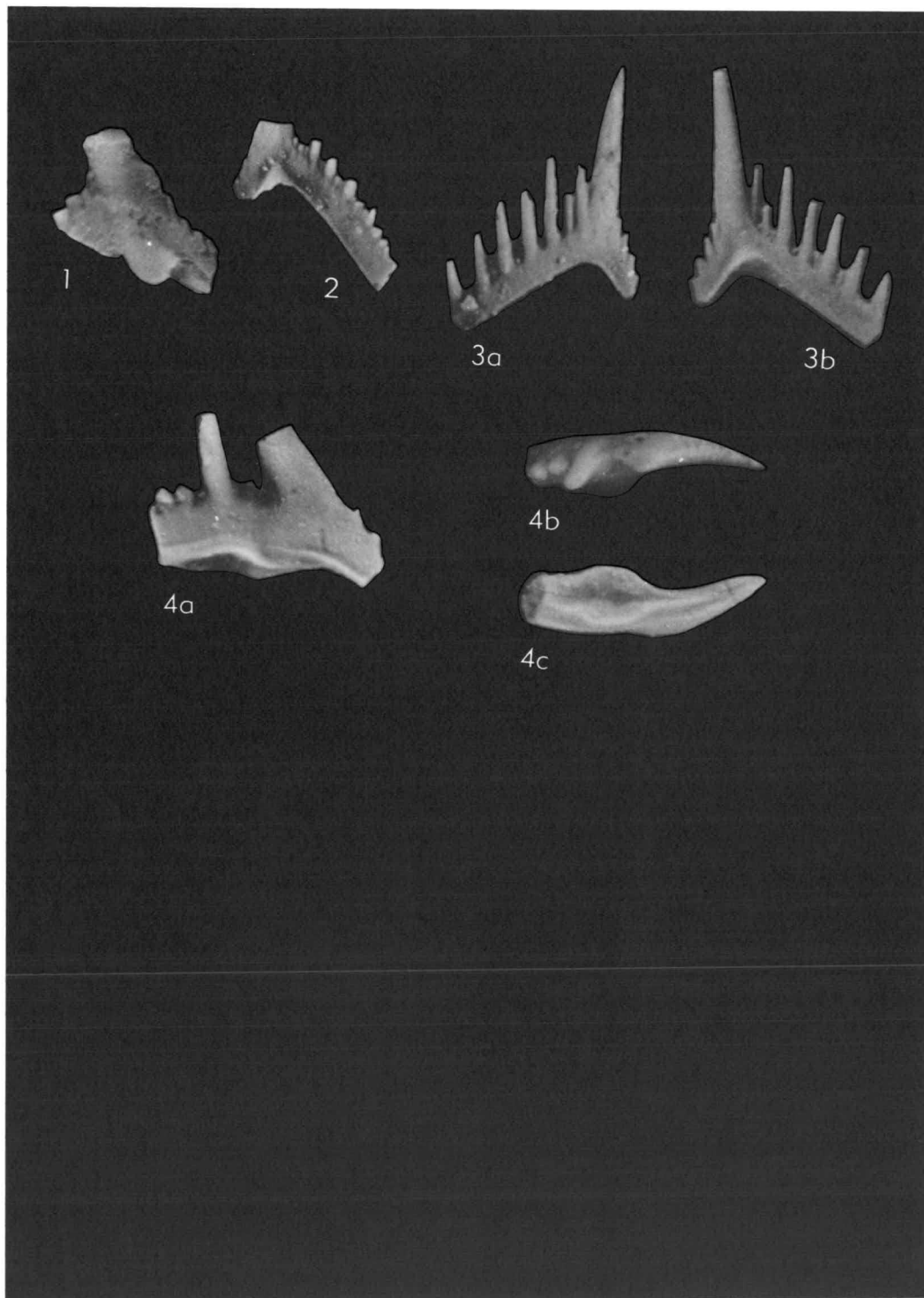
PLATE 28
All figures x50

Synprioniodina regularis E. R. Branson, 1934
(p. 33)

- 1 inner lateral view. CPC 16050 (WCB 007/40).
- 2 inner lateral view. CPC 16051 (WCB 017/44).
- 3 a—outer lateral view. b—inner lateral view. CPC 16052 (WCB 206/9).

GEN. ET SP. INDET. A
(p. 33)

- 4 a—right lateral view. b—oral view. c—aboral view. CPC 16053 (WCB 006/13).



APPENDIX A: COLLECTING LOCALITIES

Samples used in this study were obtained from 39 localities. Some of these were measured sections, others were traverses or spot samples. Below are listed each of the localities and their location data. Under 'Samples collected', the number 1-12 (10) indicates a section of twelve 1.5-metre intervals from which 10 samples were collected. This figure gives an idea of the degree of coverage of the measured sections provided by the sampling.

Collectors are identified by the initials E.C.D. (E. C. Druce), R.S.N. (R. S. Nicoll), or B.M.R. (B. M. Radke).

Locality WCB 001

1:250 000 sheet SE/51-12 Noonkanbah
18°08'00"S, 125°28'00"E
1:100 000 sheet 3961 Cunningham
Grid reference: 614934 to 607938
Units sampled/Samples collected:
Gumhole Formation 1-17 (17)
Remarks: Measured section, connects with base of section 202
Location: Samples from ditches each side of Great Northern Highway, 2.5 km SE of Gumhole Bore
Collected by E.C.D.

Locality WCB 002

1:250 000 sheet SE/51-12 Noonkanbah
18°04'15"S, 125°26'35"E
1:100 000 sheet 3961 Cunningham
Grid reference: 588004 to 584003
Units sampled/Samples collected:
Gumhole Formation 1-14B (15)
Remarks: Measured section
Location: Section starts NNE side of Oscar Hill and extends to top of hill
Collected by E.C.D.

Locality WCB 003

1:250 000 sheet SE/51-12 Noonkanbah
18°04'S 125°26'E
1:100 000 sheet 3961 Cunningham
Grid reference: (Oscar Hill) 585003
Units sampled/Samples collected:
Gumhole Formation 1-3 (3)
Yellow Drum Sandstone 4-5 (2)
Remarks: Spot samples 2 to 4 km SE to SW of Oscar Hill
Location: Scattered samples
Collected by E.C.D.

Locality WCB 004

1:250 000 sheet SE/51-12 Noonkanbah
18°04'30"S, 125°24'40"E
1:100 000 sheet 3961 Cunningham
Grid reference: 557989 to 550003
Units sampled/Samples collected:
Yellow Drum Sandstone 1-11 (11)
Remarks: 1-9 measured section, 10 & 11 down dip, 0.8 km & 1.3 km respectively from 9
Location: Section line astride a low ridge N of Great Northern Hwy
Collected by E.C.D.

Locality WCB 005

1:250 000 sheet SE/51-12 Noonkanbah
18°04'S, 125°26'E
1:100 000 sheet 3961 Cunningham
Grid reference: (Oscar Hill) 585003
Units sampled/Samples collected:
Yellow Drum Sandstone 1-5 (5)
Gumhole Formation 6-7 (2)
Remarks: Spot samples
Location: Samples scattered, from along creek 1-2 km NW of Oscar Hill
Collected by E.C.D.

Locality WCB 006

1:250 000 sheet SE/51-8 Lennard River
17°56'S, 125°14'50"E
1:100 000 sheet 3962 Leopold Downs
Grid reference: 379163 to 379159
Units sampled/Samples collected:
Laurel Formation 1-15 (6)
Remarks: May equate to top part of locality 101
Location: Crosses station track 3 km W of Twelve Mile Bore
Collected by E.C.D.

Locality WCB 007

1:250 000 sheet SE/51-8 Lennard River
17°53'00"S, 125°11'40"E
1:100 000 sheet 3962 Leopold Downs
Grid reference: 328223 to 324213
Units sampled/Samples collected:
Laurel Formation 1-46 (40)
Remarks: Measured section
Location: Along line of Mount Hardman Ck, starting near telephone line
Collected by E.C.D.

Locality WCB 008

1:250 000 sheet SE/51-8 Lennard River
17°55'S, 125°04'30"E
1:100 000 sheet 3962 Leopold Downs
Grid reference: 383173 to 368182
Units sampled/Samples collected:
Yellow Drum Sandstone 1-8 (8)
Remarks: Spot sample traverse
Location: Along northern edge of limestone ridge, 4 km NW of Twelve Mile Bore.
Collected by E.C.D.

Locality WCB 010

1:250 000 sheet SE/51-8 Lennard River
17°11'S, 124°34'E
1:100 000 sheet 3863 Lennard
Grid reference: 695008 to 625978
Units sampled/Samples collected:
Gumhole Formation 1-33 (33)
Yellow Drum Sandstone 34-40 (7)
Laurel Formation 41-42 (2)
Remarks: Traverse along stream course, outcrop poor
Location: Traverse line in and either side of Station Creek, 17-22 km NW of Barker Gorge
Collected by E.C.D.

Locality WCB 011

1:250 000 sheet SE/51-8 Lennard River
17°52'10"S, 125°11'40"E
1:100 000 sheet 3962 Leopold Downs
Grid reference: 331225 to 328223
Units sampled/Samples collected:
Laurel Formation 1-3 (3)
Remarks: Additional outcrop at base of section WCB 007
Location: Along Mount Hardman Ck
Collected by E.C.D.

Locality WCB 012

1:250 000 sheet SE/51-8 Lennard River
 17°53'30"S, 125°12'50"E
 1:100 000 sheet 3962 Leopold Downs
 Grid reference: 354201 to 348197
 Units sampled/ Samples collected:
 Gumhole Formation 1 (1)
 Laurel Formation 2-3 (2)
 Remarks: Parallel to section 212, traverse on poor exposure
 Location: Line of section roughly parallel to Linesman Creek, base of section is at the telephone line
 Collected by E.C.D.

Locality WCB 013

1:250 000 sheet SE/51-8 Lennard River
 17°56'40"S, 125°16'40"E
 1:100 000 sheet 3962 Leopold Downs
 Grid reference: 412150 to 410143 (sample 013/1-403150)
 Units sampled/Samples collected:
 Laurel Formation 1-64 (19)
 Remarks: Lower part of section 017, west of minor fault
 Location: 0.7 km E of Twelve Mile Bore (sample 013/1 is 0.2 km W of Twelve Mile Bore)
 Collected by E.C.D.

Locality WCB 014

1:250 000 sheet SE/52-9 Mount Ramsay
 18°51'30"S, 126°27'30"E
 1:100 000 sheet 4160 Bohemia
 Grid reference: 326127 to 315117
 Units sampled/Samples collected:
 Gumhole Formation 1-16 (16)
 Remarks: Measured section
 Location: Base of section 1.5 km SSW of Nipper Bore
 Collected by E.C.D.

Locality WCB 015

1:250 000 sheet SE/62-9 Mount Ramsay
 18°51'00"S, 126°28'00"E
 1:100 000 sheet 4160 Bohemia
 Grid reference: 333133 and 323141
 Units sampled/Samples collected:
 Gumhole Formation 1-2 (2)
 'birdseye limestone' 3 (1)
 Remarks: Spot samples
 Location: 1 km S of Nipper Bore
 Collected by E.C.D.

Locality WCB 016

1:250 000 sheet SE/52-9 Mount Ramsay
 18°51'20"S, 126°30'00"E
 1:100 000 sheets 4260-4160 Ramsay-Bohemia
 Grid reference: 369137 to 364133
 Units sampled/Samples collected:
 'birdseye limestone' 1-8 (8)
 Remarks: Measured section
 Location: 1 km W of Pineapple Bore, south side of Christmas Ck
 Collected by E.C.D.

Locality WCB 017

1:250 000 sheet SE/51-8 Lennard River
 17°56'40"S, 125°16'40"E
 1:100 000 sheet 3962 Leopold Downs
 Grid reference: 412150 to 410143
 Units sampled/Samples collected:
 Laurel Formation 1-75 (27)
 Remarks: Continues section 013, but located SE of minor fault, measured section
 Location: 1 km SE of Twelve Mile Bore
 Collected by E.C.D.

Locality WCB 018

1:250 000 sheet SE/51-8 Lennard River
 17°24'10"S, 124°51'10"E
 1:100 000 sheet 3863 Lennard
 Grid reference: 970749
 Units sampled/Samples collected:
 Gumhole Formation 1-3
 Remarks: Spot samples, poor exposure
 Location: In bed of Lennard River 9 km W of Windjana Gorge
 Collected by E.C.D.

Locality WCB 019

1:250 000 sheet SE/51-8 Lennard River
 17°24'S, 124°52'E
 1:100 000 sheet 3963 Lennard
 Grid reference: 968748 to 972749
 Units sampled/Samples collected:
 Gumhole Formation 1-3 (3)
 Remarks: Spot samples
 Location: Samples from bed of Lennard River, 9.5 km W of Windjana Gorge
 Collected by E.C.D.

Locality WCB 101

1:250 000 sheet SE/51-8 Lennard River
 17°55'40"S, 125°15'00"E
 1:100 000 sheet 3962 Leopold Downs
 Grid reference: 383170 to 377163
 Units sampled/Samples collected:
 Laurel Formation 1-88 (39)
 Remarks: Measured section, lower part of Thomas's type section of Laurel Fm
 Location: Edge of black soil plain on low ridge, 3 km NW of Twelve Mile Bore
 Collected by R.S.N. & E.C.D.

Locality WCB 102

1:250 000 sheet SE/51-8 Lennard River
 17°58'30"S, 125°17'30"E
 1:100 000 sheet 3962 Leopold Downs
 Grid reference: 429116 to 420115
 Units sampled/Samples collected:
 Laurel Formation 1-13 (13)
 Remarks: Traverse section, base of upper part of Thomas's type section of Laurel Fm
 Location: Across black soil plain, starting along road 4.5 km SE of Twelve Mile Bore
 Collected by R.S.N.

Locality WCB 103

1:250 000 sheet SE/51-8 Lennard River
 17°58'50"S, 125°16'30"E
 1:100 000 sheet 3962 Leopold Downs
 Grid reference: 414103 to 409114
 Units sampled/Samples collected:
 Laurel Formation 1-88 (43)
 Remarks: Measured section, uppermost part of Thomas's type section of Laurel Fm
 Location: Edge of black soil plain to adjacent hill slope, 5 km S of Twelve Mile Bore
 Collected by R.S.N.

Locality WCB 104

1:250 000 sheet SE/51-12 Noonkanbah
 18°04'00"S, 125°21'10"E
 1:100 000 sheet 3961 Cunningham
 Grid reference: 485003 to 495009
 Units sampled/Samples collected:
 Laurel Formation 1-45 (25)
 Remarks: Measured section
 Location: South of Great Northern Hwy, 0.2 km E of Two Wells Bore
 Collected by R.S.N.

Locality WCB 201

1:250 000 sheet SE/51-12 Noonkanbah
18°08'00"S, 125°27'20"E
1:100 000 sheet 3961 Cunningham
Grid reference: 597930 to 597937
Units sampled/Samples collected:
Gumhole Formation 1-12 (12)
Remarks: Measured section, probably duplicates part of sections 001 and 202
Location: South side of low ridge, just S of the Great Northern Hwy
Collected by B.M.R.

Locality WCB 202

1:250 000 sheet SE/51-12 Noonkanbah
18°07'45"S, 125°27'40"E
1:100 000 sheet 3961 Cunningham
Grid reference: 605937 to 598940
Units sampled/Samples collected:
Gumhole Formation 1-30 (26)
Remarks: Measured section, continues line of section 001 after slight offset
Location: SW side of Great Northern Hwy, on low ridge, 2 km S of Gumhole Bore
Collected by B.M.R.

Locality WCB 203

1:250 000 sheet SE/51-12 Noonkanbah
18°07'40"S, 125°27'20"E
1:100 000 sheet 3961 Cunningham
Grid reference: 595940
Units sampled/Samples collected:
Gumhole Formation 1 (1)
Remarks: Spot sample, continues line of sections 001 and 202
Location: SW side of Great Northern Hwy on low ridge, 2 km S of Gumhole Bore
Collected by B.M.R.

Locality WCB 204

1:250 000 sheet SE/51-12 Noonkanbah
18°02'50"S, 125°26'30"E
1:100 000 sheet 3961 Cunningham
Grid reference: 573024 to 594036
Units sampled/Samples collected:
Gumhole Formation 1-3 (3)
Remarks: Traverse, poor exposure
Location: Across plain in front of Oscar Range, vicinity of Two Mile Bore
Collected by B.M.R.

Locality WCB 205

1:250 000 sheet SE/51-8 Lennard River
17°37'20"S, 124°56'30"E
1:100 000 sheet 3862 Ellendale
Grid reference: 062508
Units sampled/Samples collected:
Gumhole Formation 1-4 (4)
Remarks: Measured section, continues line of section 206
Location: 2 km E of Mount Percy
Collected by B.M.R.

Locality WCB 206

1:250 000 sheet SE/51-8 Lennard River
17°37'20"S, 124°56'20"E
1:100 000 sheet 3862 Ellendale
Grid reference: 062508 to 055510
Units sampled/Samples collected:
Gumhole Formation 0-29 (30)
Remarks: Measured section, continues line of section 005
Location: Along low bedrock ridge, 1.5 km E of Mount Percy
Collected by B.M.R.

Locality WCB 207

1:250 000 sheet SE/51-8 Lennard River
17°37'05"S, 124°56'00"E
1:100 000 sheet 3862 Ellendale
Grid reference:
054511 to 046513
Units sampled/Samples collected:
Gumhole Formation 0.65 (30)
Remarks: Continues line of section 206 but separated by a fault
Location: 1 km E of Mount Percy
Collected by B.M.R.

Locality WCB 208

1:250 000 sheet SE/51-8 Lennard River
17°39'40"S, 124°56'30"E
1:100 000 sheet 3862 Ellendale
Grid reference: 062460 to 058466
Units sampled/Samples collected:
'birdseye limestone' 1-8 (8)
Remarks: Traverse section
Location: In rough limestone ridges on west end of Oscar Plateau
Collected by B.M.R.

Locality WCB 212

1:250 000 sheet SE/51-8 Lennard River
17°53'30"S, 125°13'00"E
1:100 000 sheet 3962 Leopold Downs
Grid reference: 350204 to 346199
Units sampled/Samples collected:
Gumhole Formation 0A-1 (3)
Laurel Formation 6-59 (6)
Remarks: Measured section with very poor exposure
Location: Parallels section 012, line of section roughly parallel to Linesman Creek, base of section is at the telephone line
Collected by B.M.R.

Locality WCB 218

1:250 000 sheet SE/52-9 Mount Ramsay
18°9'10"S, 126°21'30"E
1:100 000 sheet 4162 Elma
Grid reference: 047911 to 048904
Units sampled/Samples collected:
'birdseye limestone' 1-2 (2)
Gumhole Formation 3-11 (7)
Remarks: Traverse samples 1 & 2, measured section 3-11, very poor exposure
Location: Across station track, 5 km W of Leopold River
Collected by B.M.R.

Locality WCB 219

1:250 000 sheet SE/52-9 Mount Ramsay
18°11'10"S, 126°14'10"E
1:100 000 sheet 4161 Elma
Grid reference: 077865 to 081870
Units sampled/Samples collected:
'birdseye limestone' 1-4 (2)
Gumhole Formation 5-31 (7)
Remarks: Measured section, poor exposure in upper part
Location: Edge of Horseshoe Range, 4 km SW of Blood Yard
Collected by B.M.R.

Locality WCB 220

1:250 000 sheet SE/52-9 Mount Ramsay
18°11'45"S, 126°13'10"E
1:100 000 sheet 4161 Elma
Grid reference: 060858 to 056869
Units sampled/Samples collected:
'birdseye limestone' 1 (1)
Gumhole Formation 2-8 (6)
Remarks: Measured section
Location: East margin of semi-enclosed basin in Horseshoe Range
Collected by B.M.R.

Locality WCB 221

1:250 000 sheet SE/52-9 Mount Ramsay
18°11'40"S, 126°12'35"E
1:100 000 sheet 4161 Elma
Grid reference: 048862
Units sampled/Samples collected:
Gumhole Formation 1 (1)
Remarks: Spot sample
Location: Near center of semi-enclosed basin in Horseshoe Range
Collected by B.M.R.

Locality WCB 222

1:250 000 sheet SE/52-9 Mount Ramsay
18°11'40"S, 126°12'00"E
1:100 000 sheet 4161 Elma
Grid reference: 033856 to 041859
Units sampled/ Samples collected:
'birdseye limestone' 1 (1)
Gumhole Formation 2-12 (7)
Remarks: Measured section
Location: Section on west side of semi-enclosed basin with-
in Horseshoe Range
Collected by B.M.R. & E.C.D.

Locality WCB 223

1:250 000 sheet SE/51-8 Lennard River
17°19'00"S, 124°44'00"E
1:100 000 sheet 3863 Lennard
Grid reference: 839840 to 845855
Units sampled/Samples collected:
Yellow Drum Sandstone 1-3 (3)
Laurel Formation 4 (1)
Remarks: Spot samples, poor exposure
Location: 3 km SE of Wombarella Gap
Collected by B.M.R.

Locality BMR Lennard River 1

1:250 000 sheet SE/51-8 Lennard River
17°55'25"S, 125°15'05"E
1:100 000 sheet 3962 Leopold Downs
Grid reference: 383170
Units sampled/Samples collected:
Laurel Formation 1 (1)
Yellow Drum Sandstone 2-20 (19)
Remarks: BMR stratigraphic drillhole, continuous coring
3-63.4 m (TD); location at base of locality 101
Location: 3 km NW of Twelve Mile Bore
Collected by E.C.D., R.S.N., B.M.R.

Locality BMR Lennard River 2

1:250 000 sheet SE/51-8 Lennard River
17°58'20"S, 125°16'30"E
1:100 000 sheet Leopold Downs
Grid reference: 409117
Units sampled/Samples collected:
Grant Formation 1 (1)
Laurel Formation 2-25 (24)
Remarks: BMR stratigraphic drillhole, continuous coring
14-68.9 m (TD); samples unexposed section above
locality 103 = uppermost part of type Laurel Fm
Location: 3.5 km SE of Twelve Mile Bore
Collected by E.C.D., R.S.N., B.M.R.

Locality BMR Noonkanbah 4

1:250 000 sheet SE/51-12 Noonkanbah
18°04'30"S, 125°25'00"E
1:100 000 sheet 3961 Cunningham
Grid reference: 557997
Units sampled/Samples collected:
Yellow Drum Sandstone 1-22 (22)
Remarks: BMR stratigraphic drillhole, continuous coring 3.3
to 68.9 m (TD)
Location: Near crest of low ridge, N of Great Northern
Hwy near Section WCB 004
Collected by E.C.D. & B.M.R.

APPENDIX B: INDEX AND REGISTER OF FIGURED SPECIMENS

No. of conodont species	Slide Nos. of figured specimens	Sample No.	Formation
<i>Icriodus platys</i> (S ₁ element)	CPC 15919	WCB 002/12	Gumhole
	CPC 15920	WCB 002/12	Gumhole
(I element)	CPC 15921 Paratype	WCB 218/5	Gumhole
	CPC 15922 Holotype	WCB 218/5	Gumhole
	CPC 15923 Paratype	WCB 001/9	Gumhole
	CPC 15924 Paratype	WCB 002/6	Gumhole
<i>Pelekyognathus australis</i>	CPC 15816 Paratype	WCB 010/26	Gumhole
(I element)	CPC 15817 Paratype	WCB 010/26	Gumhole
	CPC 15818 Paratype	WCB 001/9	Gumhole
	CPC 15819 Paratype	WCB 219/5	Gumhole
	CPC 15820 Holotype	WCB 010/26	Gumhole
	CPC 15821 Paratype	WCB 010/26	Gumhole
	CPC 15822 Paratype	WCB 010/9	Gumhole
(S ₂ element)	CPC 15823 Paratype	WCB 205/2	Gumhole
	CPC 15824 Paratype	WCB 010/26	Gumhole
	CPC 15825 Paratype	WCB 206/8	Gumhole
	CPC 15826 Paratype	WCB 010/26	Gumhole
	CPC 15827 Paratype	WCB 010/13	Gumhole
	CPC 15828 Paratype	WCB 010/26	Gumhole
(M _{2a} element)	CPC 15829 Paratype	WCB 002/1	Gumhole
	CPC 15830 Paratype	WCB 202/6	Gumhole
	CPC 15831 Paratype	WCB 218/1	'birdseye 1st.'
	CPC 15832 Paratype	WCB 202/6	Gumhole
	CPC 15833 Paratype	WCB 002/1	Gumhole
	CPC 15834 Paratype	WCB 218/1	'birdseye 1st.'
(M _{2b} element)	CPC 15835 Paratype	WCB 010/26	Gumhole
	CPC 15836 Paratype	WCB 010/17	Gumhole
	CPC 15837 Paratype	WCB 201/12	Gumhole
	CPC 15838 Paratype	WCB 010/26	Gumhole
	CPC 15839 Paratype	WCB 001/9	Gumhole
	CPC 15840 Paratype	WCB 205/2	Gumhole
Apparatus A (Pb element)	CPC 15841	WCB 104/38	Laurel
	CPC 15842	WCB 104/30	Laurel
(N element)	CPC 15843	WCB 012/2	Laurel
	CPC 15844	WCB 012/2	Laurel
	CPC 15845	WCB 013/39	Laurel
(Sa element)	CPC 15854	WCB 012/2	Laurel
	CPC 15855	WCB 012/2	Laurel
	CPC 15856	WCB 012/2	Laurel
(Sc element)	CPC 15846	WCB 012/2	Laurel
	CPC 15847	WCB 012/2	Laurel
	CPC 15848	WCB 013/39	Laurel
	CPC 15849	WCB 013/20	Laurel
(Sb element)	CPC 15850	WCB 012/2	Laurel
	CPC 15851	WCB 012/3	Laurel
	CPC 15852	WCB 104/45	Laurel
	CPC 15853	WCB 012/3	Laurel
<i>Acodina</i> sp. A	CPC 15857	WCB 001/9	Gumhole
	CPC 15858	WCB 001/9	Gumhole
	CPC 15859	WCB 202/7	Gumhole
	CPC 15860	WCB 202/25	Gumhole
<i>Acodina</i> sp. B	CPC 15861	WCB 001/17	Gumhole
	CPC 15862	WCB 201/11	Gumhole
<i>Anchignathodus cristulus</i>	CPC 15863	WCB 013/20	Laurel
	CPC 15864	WCB 012/2	Laurel
	CPC 15865	WCB 104/25	Laurel
	CPC 15866	WCB 101/23	Laurel
	CPC 15867	WCB 103/63	Laurel
	CPC 15868	WCB 012/2	Laurel
<i>Angulodus compressa</i>	CPC 15869	WCB 017/20	Laurel
	CPC 15870	WCB 201/9	Laurel
	CPC 15871	WCB 007/23	Laurel
<i>Angulodus pergracilis</i>	CPC 15872	WCB 007/27	Laurel
	CPC 15873	WCB 218/5	Gumhole
	CPC 15874	WCB 007/26	Laurel
	CPC 15875	WCB 019/2	Gumhole
	CPC 15876	WCB 007/40	Laurel

<i>No. of conodont species</i>	<i>Slide Nos. of figured specimens</i>	<i>Sample No.</i>	<i>Formation</i>
<i>Bispathodus aculeatus aculeatus</i>	CPC 16016	WCB 103/63	Laurel
	CPC 16017	WCB 103/23	Laurel
<i>Bispathodus aculeatus plumulus</i>	CPC 16027	WCB 007/4	Laurel
	CPC 16028	WCB 007/4	Laurel
	CPC 16029	WCB 007/15	Laurel
	CPC 16030	WCB 007/3	Laurel
	CPC 16031	WCB 007/41	Laurel
	CPC 16032	WCB 007/1	Laurel
<i>Bispathodus spinulicostatus</i>	CPC 16039	WCB 103/53	Laurel
	CPC 16040	WCB 103/23	Laurel
	CPC 16041	WCB 103/23	Laurel
	CPC 16042	WCB 103/53	Laurel
	CPC 16043	WCB 103/1	Laurel
<i>Bispathodus ziegleri</i>	CPC 16044	WCB 002/1	Gumhole
<i>Clydagnathus cavusformis</i>	CPC 15879	BMR Lennard R. No. 2/10	Laurel
	CPC 15880	WCB 006/9	Laurel
	CPC 15881	WCB 007/30	Laurel
	CPC 15882	WCB 007/41	Laurel
	CPC 15883	WCB 007/30	Laurel
<i>Clydagnathus gilwernensis</i>	CPC 15877	BMR Lennard R. No. 2/10	Laurel
	CPC 15878	WCB 007/3	Laurel
<i>Dinodus</i> sp.	CPC 15884	WCB 012/2	Laurel
<i>Gnathodus</i> sp.	CPC 15885	WCB 103/1	Laurel
<i>Hibbardella brevialata</i>	CPC 15886	WCB 102/10	Laurel
<i>Hibbardella?</i> <i>helmsi</i>	CPC 15887	WCB 002/13	Gumhole
<i>Hibbardella</i> cf. <i>H. insignis</i>	CPC 15888	WCB 007/23	Laurel
	CPC 15889	WCB 007/41	Laurel
	CPC 15890	WCB 202/29	Gumhole
<i>Hibbardella</i> cf. <i>H. micra</i>	CPC 15891	WCB 017/34	Laurel
	CPC 15892	WCB 017/34	Laurel
	CPC 15893	WCB 017/15	Laurel
	CPC 15894	WCB 010/8	Gumhole
<i>Hibbardella</i> (<i>H.</i>) sp. nov. Druce	CPC 15895	WCB 202/29	Gumhole
	CPC 15896	WCB 017/34	Laurel
	CPC 15897	WCB 202/14	Gumhole
<i>Hindeodella acuta</i>	CPC 15898	WCB 007/19	Laurel
	CPC 15899	WCB 007/36	Laurel
	CPC 15900	WCB 017/69	Laurel
<i>Hindeodella brevis</i>	CPC 15901	WCB 007/29	Laurel
	CPC 15902	WCB 010/6	Gumhole
	CPC 15903	WCB 017/69	Laurel
	CPC 15904	WCB 201/8	Gumhole
<i>Hindeodella corpulenta</i>	CPC 15905	WCB 207/44	Gumhole
	CPC 15916	WCB 010/39	Gumhole
	CPC 15917	WCB 017/16	Laurel
	CPC 15918	WCB 202/18	Gumhole
<i>Hindeodella subtilis</i>	CPC 15910	WCB 012/2	Laurel
	CPC 15911	WCB 014/16	Gumhole
	CPC 15912	WCB 202/3	Gumhole
<i>Hindeodella</i> sp. nov. A	CPC 15913	WCB 010/39	Yellow Drum
	CPC 15914	WCB 010/39	Yellow Drum
	CPC 15915	WCB 007/45	Laurel
<i>Hindeodella</i> sp. nov. B	CPC 15906	WCB 017/50	Laurel
	CPC 15907	WCB 218/5	Gumhole
	CPC 15908	WCB 010/4	Gumhole
	CPC 15909	WCB 207/44	Gumhole
<i>Ligonodina platys</i>	CPC 15925	WCB 102/10	Laurel
<i>Neoprioniodus</i> cf. <i>N. alatoideus</i>	CPC 15926	WCB 007/30	Laurel
	CPC 15927	WCB 007/30	Laurel
<i>Neoprioniodus alatus</i>	CPC 15928	WCB 017/69	Laurel
	CPC 15929	WCB 007/38	Laurel
	CPC 15930	WCB 103/49	Laurel
	CPC 15931	WCB 102/10	Laurel
<i>Neoprioniodus barbatus</i>	CPC 15934	WCB 102/6	Laurel
	CPC 15935	WCB 102/10	Laurel
	CPC 15936	WCB 102/10	Laurel

<i>No. of conodont species</i>	<i>Slide Nos. of figured specimens</i>	<i>Sample No.</i>	<i>Formation</i>
<i>Neoprioniodus</i> sp. nov. A	CPC 15932	WCB 007/40	Laurel
	CPC 15933	WCB 007/40	Laurel
	CPC 15937	WCB 019/1	Gumhole
<i>Ozarkodina abnormis</i>	CPC 15938	WCB 207/11	Gumhole
	CPC 15939	WCB 010/4	Gumhole
<i>Ozarkodina flexa</i>	CPC 15940	WCB 007/30	Laurel
<i>Ozarkodina</i> cf. <i>O. plana</i>	CPC 15941	WCB 017/49	Laurel
	CPC 15942	WCB 102/10	Laurel
	CPC 15943	WCB 007/41	Laurel
	CPC 15944	WCB 103/88	Laurel
	CPC 15960	WCB 017/62	Laurel
	CPC 15961	WCB 103/59	Laurel
<i>Ozarkodina rhenana</i>	CPC 15945	WCB 007/6	Laurel
	CPC 15946	WCB 007/17	Laurel
	CPC 15947	WCB 011/1	Laurel
	CPC 15948	WCB 007/26	Laurel
	CPC 15949	WCB 007/17	Laurel
	CPC 15950	WCB 013/36	Laurel
	CPC 15951	WCB 017/49	Laurel
	CPC 15952	WCB 007/17	Laurel
	CPC 15953	WCB 017/67	Laurel
	CPC 15954	WCB 007/29	Laurel
<i>Ozarkodina</i> sp. A	CPC 15959	WCB 007/40	Laurel
<i>Patrognathus</i> sp. A	CPC 15957	BMR Lennard R. No. 1/10	Yellow Drum
	CPC 15958	BMR Lennard R. No. 1/11	Yellow Drum
<i>Polygnathus burtensis</i>	CPC 15956	WCB 103/76	Laurel
<i>Polygnathus communis collinsoni</i>	CPC 15962	WCB 019/2	Gumhole
	CPC 15963	WCB 019/2	Gumhole
	CPC 15964	WCB 019/2	Gumhole
	CPC 15965	WCB 019/2	Gumhole
	CPC 15966	WCB 019/2	Gumhole
	CPC 15967	WCB 019/2	Gumhole
<i>Polygnathus communis communis</i>	CPC 15955	WCB 102/10	Gumhole
<i>Polygnathus inornatus</i>	CPC 15968	WCB 007/3	Laurel
	CPC 15969	WCB 102/10	Laurel
	CPC 15970	WCB 102/10	Laurel
<i>Polygnathus</i> aff. <i>P. lacinatus</i>	CPC 15971	WCB 212/8	Laurel
<i>Polygnathus thomasi</i>	CPC 15977	WCB 007/13	Laurel
	CPC 15978	WCB 013/39	Laurel
? <i>Polygnathus</i> sp. A	CPC 15974	WCB 004/8	Yellow Drum
	CPC 15975	WCB 005/1	Yellow Drum
	CPC 15976	BMR Noonkanbah No. 4/9	Yellow Drum
<i>Polygnathus</i> spp.	CPC 15972	WCB 017/5	Laurel
	CPC 15973	WCB 011/2	Laurel
<i>Prioniodina?</i> <i>symmetrica</i>	CPC 15979	WCB 007/38	Laurel
	CPC 15980	WCB 207/36	Gumhole
	CPC 15981	WCB 101/53	Laurel
	CPC 15982	WCB 202/27	Gumhole
<i>Pseudopolygnathus</i> cf. <i>Ps. dentilineatus</i>	CPC 15983	WCB 103/87	Laurel
	CPC 15984	WCB 103/73	Laurel
	CPC 15985	WCB 103/73	Laurel
	CPC 15986	WCB 103/87	Laurel
	CPC 15987	WCB 103/73	Laurel
	CPC 15988	WCB 103/87	Laurel
<i>Pseudopolygnathus multistriatus</i>	CPC 15989	WCB 101/33	Laurel
	CPC 15990	WCB 007/31	Laurel
	CPC 15991	WCB 101/33	Laurel
	CPC 15992	WCB 101/33	Laurel
	CPC 15993	WCB 017/53	Laurel
	CPC 15994	WCB 017/53	Laurel
<i>Pseudopolygnathus</i> cf. <i>Ps. nodomarginatus</i>	CPC 15995	WCB 017/62	Laurel
<i>Siphonodella</i> cf. <i>S. cooperi hassi</i>	CPC 15996	WCB 012/2	Laurel
<i>Siphonodella</i> spp.	CPC 15997	WCB 212/13	Laurel

<i>No. of conodont species</i>	<i>Slide Nos. of figured specimens</i>	<i>Sample No.</i>	<i>Formation</i>
<i>Spathognathodus aciedentatus</i>	CPC 15998	WCB 212/1	Gumhole
	CPC 15999	WCB 202/3	Gumhole
	CPC 16000	WCB 201/4	Gumhole
	CPC 16001	WCB 202/29	Gumhole
	CPC 16002	WCB 218/5	Gumhole
	CPC 16003	WCB 001/9	Gumhole
	CPC 16004	WCB 001/9	Gumhole
	CPC 16005	WCB 002/1	Gumhole
	CPC 16006	WCB 002/10	Gumhole
	CPC 16007	WCB 002/9	Gumhole
	CPC 16008	WCB 202/24	Gumhole
	CPC 16009	WCB 002/6	Gumhole
	CPC 16010	WCB 206/26	Gumhole
<i>Spathognathodus canningensis</i>	CPC 16011 Paratype	WCB 103/76	Laurel
	CPC 16012 Holotype	WCB 103/76	Laurel
	CPC 16013 Paratype	WCB 103/60	Laurel
	CPC 16014 Paratype	WCB 102/10	Laurel
	CPC 16015 Paratype	WCB 017/15	Laurel
<i>Spathognathodus crassidentatus</i>	CPC 16018	WCB 007/26	Laurel
	CPC 16019	WCB 102/12	Laurel
	CPC 16020	WCB 207/8	Gumhole
	CPC 16021	WCB 017/42	Laurel
	CPC 16022	WCB 222/9	Gumhole
<i>Spathognathodus mehlbrai</i>	CPC 16023	WCB 019/2	Gumhole
	CPC 16024	WCB 019/3	Gumhole
	CPC 16025	WCB 002/14A	Gumhole
	CPC 16026	WCB 212/0	Gumhole
<i>Spathognathodus</i> cf. <i>S. robustus</i>	CPC 16033	WCB 103/23	Laurel
	CPC 16034	WCB 007/17	Laurel
	CPC 16035	WCB 103/87	Laurel
	CPC 16036	WCB 007/38	Laurel
	CPC 16037	WCB 017/67	Laurel
	CPC 16038	WCB 007/40	Laurel
<i>Spathognathodus?</i> sp. nov. A	CPC 16045	WCB 218/1	'birdseye lst.'
	CPC 16046	WCB 218/1	'birdseye lst.'
	CPC 16047	WCB 218/1	'birdseye lst.'
	CPC 16048	WCB 218/1	'birdseye lst.'
	CPC 16049	WCB 218/1	'birdseye lst.'
<i>Synprioniodina regularis</i>	CPC 16050	WCB 007/40	Laurel
	CPC 16051	WCB 017/44	Laurel
	CPC 16052	WCB 206/9	Gumhole
Gen. et sp. indet. A	CPC 16053	WCB 006/13	Laurel

APPENDIX C: TABLES OF NUMERICAL DISTRIBUTION OF CONODONTS

In the following tables the numerical distribution of all conodont elements is given for each sample collected. The following abbreviations are used:

B = 'birdseye limestone'

G = Gumhole Formation

Y = Yellow Drum Sandstone

L = Laurel Formation

T = total conodont elements of a given species in the section in question

X in the top of a column indicates that there were no conodont elements in the sample.

Tables A1 to A44 show numerical distribution of species in:

A1. Each stratigraphic unit.

A2. Sections of the 'birdseye limestone'.

A3. Sections of the Gumhole Formation.

A4. Sections of the Yellow Drum Sandstone.

A5. Sections of the Laurel Formation.

A6. Section 001.

A7. Section 002.

A8. Section 003.

A9. Section 004.

A10. Section 005.

A11. Section 006.

A12. Section 007.

A13. Section 008.

A14. Section 010.

A15. Section 011.

A16. Section 012.

A17. Section 013.

A18. Section 014.

A19. Section 015.

A20. Section 016.

A21. Section 017.

A22. Section 019.

A23. Section 101.

A24. Section 102.

A25. Section 103.

A26. Section 104.

A27. Section 201.

A28. Section 202.

A29. Section 203.

A30. Section 204.

A31. Section 205.

A32. Section 206.

A33. Section 207.

A34. Section 208.

A35. Section 212.

A36. Section 218.

A37. Section 219.

A38. Section 220.

A39. Section 221.

A40. Section 222.

A41. Section 223.

A42. BMR Lennard River No. 1 well.

A43. BMR Lennard River No. 2 well.

A44. BMR Noonkanbah No. 4 well.

Table A1.

SAMPLE INTERVAL					
FORMATION (B = Birdseye; G = Gumhole; Y = Yellow Drum; L = Laurel; T = Total)	B	G	Y	L	T
1 element		70			70
S ₁ element		4			4
<i>Pelekysgnathus australis</i>					
1 element	10	175	2		187
S ₂ element	1	118	1	1	121
M _{2a} element	6	89	2	1	98
M _{2b} element	6	130			136
Apparatus A					
Pb element				2	2
N element				8	8
Sa element				16	16
Sc element				11	11
Sb element				11	11
<i>Acodina</i> sp. A		12			12
<i>Acodina</i> sp. B		2			2
<i>Anchignathodus cristulus</i>			1	21	22
<i>Anquilodus compressa</i>	1	17		67	85
<i>Anquilodus perigracilis</i>		4	25		29
<i>Apatognathus</i> sp.		2			2
<i>Bispathodus aculeatus aculeatus</i>				41	41
<i>Bispathodus aculeatus plumulus</i>			9	124	133
<i>Bispathodus spinulicostatus</i>				15	15
<i>Bispathodus ziegléri</i>		1			1
<i>Clydagnathus cavusformis</i>			2	721	723
<i>Clydagnathus gilwernensis</i>			6	51	58
<i>Dinodus</i> sp.					1
<i>Gnathodus</i> sp.				1	1
<i>Hibbardella brevislata</i>				1	1
<i>Hibbardella?</i> helmsi		4			4
<i>Hibbardella</i> cf. <i>H. insignis</i>		51	1	60	112
<i>Hibbardella</i> cf. <i>H. micra</i>		30	2	95	127
<i>Hibbardella</i> (<i>H.</i>) sp. nov. Druce		9			9
<i>Hindendella acuta</i>				6	6
<i>Hindeodella brevis</i>		13		15	28
<i>Hindeodella corpulenta</i>		46	1	70	117
<i>Hindeodella subtilis</i>	2	53		63	118
<i>Hindeodella</i> sp. nov. A		1	6	67	74
<i>Hindeodella</i> sp. nov. B		9		1	10
<i>Ligonodina platys</i>				6	6
<i>Neopriionodus</i> cf. <i>N. alatoideus</i>				6	6
<i>Neopriionodus alatus</i>			4	206	210
<i>Neopriionodus barbatus</i>				6	6
<i>Neopriionodus</i> sp. nov. A				3	3
<i>Ozarkodina abnormis</i>	1	62	4		67
<i>Ozarkodina flexa</i>				2	2
<i>Ozarkodina</i> cf. <i>O. plana</i>			1	66	67
<i>Ozarkodina rhemana</i>				70	70
<i>Ozarkodina</i> sp. A				2	2
<i>Patrognathus</i> sp. A			2		2
<i>Polygnathus burtensis</i>				1	1
<i>Polygnathus communis collinsoni</i>		80			80
<i>Polygnathus communis communis</i>			1	3	4
<i>Polygnathus inornatus</i>				32	32
<i>Polygnathus</i> cf. <i>P. lacinatus</i>			3	2	5
<i>Polygnathus thomasi</i>				2	2
? <i>Polygnathus</i> sp. A.			8		8
<i>Polygnathus</i> spp.				2	2
<i>Prioniodina?</i> symmetrica		23	1	27	51
<i>Pseudopolygnathus</i> cf. <i>Ps. dentilineatus</i>			12	60	80
<i>Pseudopolygnathus multistriatus</i>				21	21
<i>Pseudopolygnathus</i> cf. <i>Ps. nodomarginatus</i>				1	1
<i>Siphonodella</i> cf. <i>S. cooperi hassi</i>				1	1
<i>Siphonodella</i> spp.				2	2
<i>Spathognathodus acidentatus</i>	5	169	1		173
<i>Spathognathodus canningensis</i>				81	81
<i>Spathognathodus crassidentatus</i>	4	19		63	86
<i>Spathognathodus mehlbrai</i>	1	39			40
<i>Spathognathodus</i> cf. <i>S. robustus</i>				26	26
<i>Spathognathodus?</i> sp. nov. A	11				11
<i>Synpriionodina regularis</i>	5	122	1	20	148
Gen. et sp. indet. A		1			1

Table A2.[illegible]

Table A3.

SAMPLE INTERVAL	001/-17	002/-14	003/-13	004/-6	010/-13	012/-1	014/-16	015/-2	019/-3	201/-12	202/-130	203/-1	204/-7	205/-13	205/-14	206/-29	207/-165	212/-6	218/-11	219/-531	220/-28	221/-1	222/-212	
FORMATION (B Birdseye, G Gumbel)																								
Y Yellow Drum, L Laurel, T Total																								T
Unidentified																								
I element			30	3						2	1								33					70
S ₁ element	1	2																1						4
Pelekysgnathus australis																								
I element	10	17	2	1	40		3	1	15	3	16		1			30	14	9	9	1			3	175
S ₂ element	6	23	3		28		4		3	3	2			1	21	6	10	3				5		118
M _{2a} element	8	15	3		20		3			1	4		1		6	2	5	6				1	4	89
M _{2b} element	8	30		1	23		4		1	9	7	3		1	5	12	6	12	2			6		130
Apparatus A																								
Pl element																								
N element																								
Su element																								
Sc element																								
Sh element																								
Acodina sp. A	5								1	5						1								12
Acodina sp. B	1									1														2
Anchignathodus cristatus																								
Amulodus compressa	3	1		1	1		1		1	4	2					1	1		1					17
Angulodus pergracilis										2	1						1							4
Apatognathus sp.		2																						2
Bispathodus aculeatus aculeatus																								
Bispathodus aculeatus plumulus																								
Bispathodus spinulicostatus																								
Bispathodus ziegleri		1																						
Clydagnathus cavusformis																								
Clydagnathus gilwernensis																								
Dinoilus sp.																								
Gnathodus sp.																								
Hibbardella brevisalata																								
Hibbardella? helmsi		4																						4
Hibbardella cf. H. insignis	7	8		2	5		1			1	6					3	9	2			1	1	5	51
Hibbardella cf. H. micra		7	1		3				1	5						4	7	2						30
Hibbardella (H.) sp. nov. Druce	1	2							2	1	3													9
Hindeodella acuta																								
Hindeodella brevis	2	2			1					2	1					2	3							13
Hindeodella corpulenta	8	10			2				1	2	7					3	7	2	3			1		46
Hindeodella subtilis	6	13			2		2		12	//						3		4						53
Hindeodella sp. nov. A										1														1
Hindeodella sp. nov. B		1			1				2	1						1	2	1						9
Ligonodina platys																								
Neoproniodus cf. N. alatoideus																								
Neoproniodus alatus																								
Neoproniodus barbatus																								
Neoproniodus sp. nov. A																								
Ozarkodina abnormis	14	9	1		2	1			8	2	14					1	6	3				1		62
Ozarkodina flexa																								
Ozarkodina cf. O. plana																								
Ozarkodina rhenana																								
Ozarkodina sp. A																								
Patrognathus sp. A																								
Polygnathus burtensis																								
Polygnathus communis collinsoni					14				54		1					6	5							80
Polygnathus communis communis																								
Polygnathus inornatus																								
Polygnathus cf. P. facinatus																								
Polygnathus thomasi																								
?Polygnathus sp. A.																								
Polygnathus spp.																								
Prionodina? symmetrica	1	4								2	5					1	3					7		23
Pseudopolygnathus cf. Ps. dentilineatus																								
Pseudopolygnathus multistriatus																								
Pseudopolygnathus cf. Ps. nodomarginatus																								
Siphonodella cf. S. cooperi hassi																								
Siphonodella spp.																								
Spathognathodus acidentatus	19	46	3		3		2			6	34	1		1	13	18	3	5		1	1	11		167
Spathognathodus canningensis																								
Spathognathodus crassidentatus	1									1	2					1	7		2		1	4		19
Spathognathodus mehlbrai	3	3			2	1			18	1	3					1	2	4				1		39
Spathognathodus cf. S. robustus																								
Spathognathodus? sp. nov. A																								
Synprionodina regularis	17	32	1	1	5		2		11	1	27					4	7	2	5	1	2	4		122
Gen. et sp. indet. A																			1					1

Table A4.

SAMPLE INTERVAL	003	004	005	008	010	010	223	N 4	LR 1	2.17	
FORMATION (B = Birdseye; G = Gumhole; Y = Yellow Drum; L = Laurel; T = Total)											T
Ligonodina platys											
I element											
S ₁ element											
Pelekysgnathus australis											
I element											
S ₂ element											
M _{2a} element											
M _{2b} element											
Apparatus A											
Pb element											
N element											
Sa element											
Sc element											
Sb element											
Acodina sp. A											
Acodina sp. B											
Anchignathodus cristulius											
Angulodius compressa											
Angulodius porgracilis											
Apatognathus sp.											
Bispathodus aculeatus aculeatus											
Bispathodus aculeatus plumulus											
Bispathodus spinulicostatus											
Bispathodus zieglerei											
Clydagnathus cavusformis											
Clydagnathus gilwernensis											
Dinodus sp.											
Gnathodus sp.											
Hibbardella brevislata											
Hibbardella? helmsi											
Hibbardella cf. H. insignis											
Hibbardella cf. H. micra											
Hibbardella (H.) sp. nov. Druce											
Hindeodella acuta											
Hindeodella brevis											
Hindeodella corpulenta											
Hindeodella subtilis											
Hindeodella sp. nov. A											
Hindeodella sp. nov. B											
Ligonodina platys											
Neoproniodus cf. N. alatoideus											
Neoproniodus alatus											
Neoproniodus barbatus											
Neoproniodus sp. nov. A											
Ozarkodina abnormis											
Ozarkodina flexa											
Ozarkodina cf. O. plana											
Ozarkodina rhenana											
Ozarkodina sp. A											
Patrognathus sp. A											
Polygnathus burtensis											
Polygnathus communis collinsoni											
Polygnathus communis communis											
Polygnathus inornatus											
Polygnathus cf. P. lacinatus											
Polygnathus thomasi											
?Polygnathus sp. A											
Polygnathus spp.											
Prioniodina? symmetrica											
Pseudopolygnathus cf. Ps. dentilineatus											
Pseudopolygnathus multistriatus											
Pseudopolygnathus cf. Ps. nodomarginatus											
Siphonodella cf. S. cooperi hassi											
Siphonodella spp.											
Spathognathodus acidentatus											
Spathognathodus canningensis											
Spathognathodus crassidentatus											
Spathognathodus mehlbrai											
Spathognathodus cf. S. robustus											
Spathognathodus? sp. nov. A											
Synprioniodina regularis											
Gen. et sp. indet. A											

Table A5.

SAMPLE INTERVAL	006	007	010	011	012	013	017	017	017	02	02	03	04	212	223	LR 1	LR 3	2.25	
FORMATION (B = Birdseye; G = Gumhole; Y = Yellow Drum; L = Laurel; T = Total)																			T
Ligonodina platys																			
I element																			
S ₁ element																			
Pelekysgnathus australis																			
I element																			
S ₂ element																			
M _{2a} element																			
M _{2b} element																			
Apparatus A																			
Pb element																			
N element																			
Sa element																			
Sc element																			
Sb element																			
Acodina sp. A																			
Acodina sp. B																			
Anchignathodus cristulius																			
Angulodius compressa																			
Angulodius porgracilis																			
Apatognathus sp.																			
Bispathodus aculeatus aculeatus																			
Bispathodus aculeatus plumulus																			
Bispathodus spinulicostatus																			
Bispathodus zieglerei																			
Clydagnathus cavusformis																			
Clydagnathus gilwernensis																			
Dinodus sp.																			
Gnathodus sp.																			
Hibbardella brevislata																			
Hibbardella? helmsi																			
Hibbardella cf. H. insignis																			
Hibbardella cf. H. micra																			
Hibbardella (H.) sp. nov. Druce																			
Hindeodella acuta																			
Hindeodella brevis																			
Hindeodella corpulenta																			
Hindeodella subtilis																			
Hindeodella sp. nov. A																			
Hindeodella sp. nov. B																			
Ligonodina platys																			
Neoproniodus cf. N. alatoideus																			
Neoproniodus alatus																			
Neoproniodus barbatus																			
Neoproniodus sp. nov. A																			
Ozarkodina abnormis																			
Ozarkodina flexa																			
Ozarkodina cf. O. plana																			
Ozarkodina rhenana																			
Ozarkodina sp. A																			
Patrognathus sp. A																			
Polygnathus burtensis																			
Polygnathus communis collinsoni																			
Polygnathus communis communis																			
Polygnathus inornatus																			
Polygnathus cf. P. lacinatus																			
Polygnathus thomasi																			
?Polygnathus sp. A																			
Polygnathus spp.																			
Prioniodina? symmetrica																			
Pseudopolygnathus cf. Ps. dentilineatus																			
Pseudopolygnathus multistriatus																			
Pseudopolygnathus cf. Ps. nodomarginatus																			
Siphonodella cf. S. cooperi hassi																			
Siphonodella spp.																			
Spathognathodus acidentatus																			
Spathognathodus canningensis																			
Spathognathodus crassidentatus																			
Spathognathodus mehlbrai																			
Spathognathodus cf. S. robustus																			
Spathognathodus? sp. nov. A																			
Synprioniodina regularis																			
Gen. et sp. indet. A																			

Table A6.

SAMPLE INTERVAL	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	
FORMATION (B = Birdseye; G = Gumhole;	G																G	T
Y = Yellow Drum; L = Laurel; T = Total)	→																←	
<i>Ichneumon platys</i>	X	X	X		X			X				X	X					
I element																		
S ₁ element															1			1
<i>Pelekysgnathus australis</i>									5	2					1		2	10
I element							1		1	1				1			2	6
S ₂ element									5	2					1			8
M _{2a} element									6	2								8
M _{2b} element																		
Apparatus A																		
Pl element																		
N element																		
Sa element																		
Sc element																		
Sb element																		
<i>Acodina</i> sp. A									5									5
<i>Acodina</i> sp. B																	1	1
<i>Anchignathodus cristulus</i>																		
<i>Angulodus compressa</i>																	3	3
<i>Angulodus pergracilis</i>																		
<i>Apatognathus</i> sp.																		
<i>Bispathodus aculeatus aculeatus</i>																		
<i>Bispathodus aculeatus plumulus</i>																		
<i>Bispathodus spinulicostatus</i>																		
<i>Bispathodus zieglerei</i>																		
<i>Clydagnathus cavusformis</i>																		
<i>Clydagnathus gilwernensis</i>																		
<i>Dinodus</i> sp.																		
<i>Gnathodus</i> sp.																		
<i>Hibbardella brevislata</i>																		
<i>Hibbardella? helmsi</i>																		
<i>Hibbardella</i> cf. <i>H. insignis</i>				2			2			2	1							7
<i>Hibbardella</i> cf. <i>H. micra</i>																	1	1
<i>Hibbardella</i> (H.) sp. nov. Druce																		
<i>Hindeodella acuta</i>																		
<i>Hindeodella brevis</i>										1	1							2
<i>Hindeodella corpulenta</i>				2			2		1	1				1		1		8
<i>Hindeodella subtilis</i>							1		3	2						1		6
<i>Hindeodella</i> sp. nov. A																		
<i>Hindeodella</i> sp. nov. B																		
<i>Ligonodina platys</i>																		
<i>Neoproniodus</i> cf. <i>N. alatoideus</i>																		
<i>Neoproniodus alatus</i>																		
<i>Neoproniodus barbatus</i>																		
<i>Neoproniodus</i> sp. nov. A																		
<i>Ozarkodina abnormis</i>								1		8	2						3	14
<i>Ozarkodina flexa</i>																		
<i>Ozarkodina</i> cf. <i>O. plana</i>																		
<i>Ozarkodina rhenana</i>																		
<i>Ozarkodina</i> sp. A																		
<i>Patrognathus</i> sp. A																		
<i>Polygnathus burtensis</i>																		
<i>Polygnathus communis collinsoni</i>																		
<i>Polygnathus communis communis</i>																		
<i>Polygnathus inornatus</i>																		
<i>Polygnathus</i> cf. <i>P. lacinatus</i>																		
<i>Polygnathus thomasi</i>																		
? <i>Polygnathus</i> sp. A.																		
<i>Polygnathus</i> spp.																		
<i>Prioniodina? symmetrica</i>								1										1
<i>Pseudopolygnathus</i> cf. <i>Ps. dentilineatus</i>																		
<i>Pseudopolygnathus multistriatus</i>																		
<i>Pseudopolygnathus</i> cf. <i>Ps. nodomarginatus</i>																		
<i>Siphonodella</i> cf. <i>S. cooperi hassi</i>																		
<i>Siphonodella</i> spp.																		
<i>Spathognathodus acidentatus</i>					1		1	2		5	5	3			1	1		19
<i>Spathognathodus canningensis</i>																		
<i>Spathognathodus crassidentatus</i>										1								1
<i>Spathognathodus mehlbrai</i>										1					2			3
<i>Spathognathodus</i> cf. <i>S. robustus</i>																		
<i>Spathognathodus?</i> sp. nov. A																		
<i>Synprioniodina regularis</i>							1			10	2				1	3		17
Gen. et sp. indet. A																		

Table A7.

SAMPLE INTERVAL	1	2	3	4	5	6	7	8	9	10	11	12	13	14 _A	14 _B	
FORMATION (B = Birdseye; G = Gumhole; Y = Yellow Drum; L = Laurel; T = Total)	G →														G ←	T
Location: platys																
I element	2		2			1	11	10				3		1		30
S ₁ element												2		1		2
Pelekysgnathus australis																
I element	2	1	1			3	2	1				4	3			17
S ₂ element	1	2	2			3	4	6				2	1	2		23
M _{2a} element	5				1	6	1	1						2		15
M _{2b} element	3		3			6	3	1				6	5	3		30
Apparatus A																
Pb element																
N element																
Sa element																
Sc element																
Sb element																
Acodina sp. A																
Acodina sp. B																
Anchignathodus cristulus									1							1
Anaulodus compressa																
Angulodus pergracilis																
Apatognathus sp.														2		2
Bispathodus aculeatus aculeatus																
Bispathodus aculeatus plumulus																
Bispathodus spinulicostatus																
Bispathodus zieglerei	1															1
Clydagnathus cavusformis																
Clydagnathus gilwernensis																
Dinodus sp.																
Gnathodus sp.																
Hibbardella brevislata																
Hibbardella? helmsi												2	2			4
Hibbardella cf. H. insignis		1		2	1	1	1			1	1					8
Hibbardella cf. H. micra							3	2		1	1					7
Hibbardella (H.) sp. nov. Druce							2									2
Hindeodella acuta																
Hindeodella brevis							1	1								2
Hindeodella corpulenta							2	1	5			2				10
Hindeodella subtilis	1	1					7	3				1				13
Hindeodella sp. nov. A																
Hindeodella sp. nov. B					1											1
Ligonodina platys																
Neoproniodus cf. N. alatoideus																
Neoproniodus alatus																
Neoproniodus barbatus																
Neoproniodus sp. nov. A																
Ozarkodina abnormis							7	1						1		9

Table A8.[illegible]

Table A9.[illegible]**Table A10.**[illegible]

Table A11.

SAMPLE INTERVAL	1	2	q	11	13	15	
FORMATION (B - Birdseye; G - Gumhole;	L					L	T
Y - Yellow Drum; L - Laurel; T - Total)	L					L	T
Ignorant platys	x	x	x			x	
I element							
S ₁ element							
Pelekysgnathus australis							
I element							
S ₂ element							
M _{2a} element							
M _{2b} element							
Apparatus A							
Pl ₁ element							
N element							
Sa element							
Sc element							
Sb element							
Acodina sp. A							
Acodina sp. B							
Anchignathodus cristulus							
Anaplorodus compressa							
Anguliodus pergracilis							
Aparognathus sp.							
Bispathodus aculeatus aculeatus							
Bispathodus aculeatus plumulus				1	2		3
Bispathodus spinulicostatus							
Bispathodus ziegleri							
Clydagnathus cavusformis				1	5		6
Clydagnathus gilweiniensis							
Dinodus sp.							
Gnathodus sp.							
Hibbardella brevialata							
Hibbardella? helmsi							
Hibbardella cf. H. insignis				1	1		2
Hibbardella cf. H. micra					1		1
Hibbardella (H.) sp. nov. Druce							
Hindeodella acuta							
Hindeodella brevis							
Hindeodella corpulenta							
Hindeodella subtilis							
Hindeodella sp. nov. A							
Hindeodella sp. nov. B							
Ligonodina platys							
Neoproniodus cf. N. alatoideus					1		1
Neoproniodus alatus							
Neoproniodus barbatus							
Neoproniodus sp. nov. A							
Ozarkodina abnormis							
Ozarkodina flexa							
Ozarkodina cf. O. plana							
Ozarkodina rhenana							
Ozarkodina sp. A							
Patrognathus sp. A							
Polygnathus burtensis							
Polygnathus communis collinsoni							
Polygnathus communis communis							
Polygnathus ignotus							
Polygnathus cf. P. lacinatus							
Polygnathus thomasi							
?Polygnathus sp. A.							
Polygnathus spp.							
Prioniodina? symmetrica							
Pseudopolygnathus cf. Ps. dentilineatus							
Pseudopolygnathus multistriatus							
Pseudopolygnathus cf. Ps. nodomarginatus							
Siphonodella cf. S. cooperi hessi							
Siphonodella spp.							
Spathognathodus acidentatus							
Spathognathodus canningensis							
Spathognathodus crassidentatus							
Spathognathodus mehlbrai							
Spathognathodus cf. S. robustus							
Spathognathodus? sp. nov. A							
Synprioniodina regularis							
Gen. et sp. indef. A							

Table A12.[illegible]

Table A12 continued.

SAMPLE INTERVAL	21	22	23	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	45	46	
FORMATION (B Birdseye, G Gumhole)																				L		T
Y Yellow Drum, L Laurel, T Total																				←		
Lithonodina platys																						
I element																						
S ₁ element																						
Peleknognathus australis																						
I element																						
S ₂ element																						
M _{2a} element																						
M _{2b} element																						
Apparatus A																						
Plu element																						
N element																						
Sa element																						
Sc element																						
Sb element																						
Acodina sp. A																						
Acodina sp. B																						
Anchignathodus cristulus																						
Angulodus compressa				1		1	1	2			1	3					2		2	3		21
Angulodus perigracilis	1		1	2	1		1				2	1					2			1		13
Apatognathus sp.																						
Bispathodus aculeatus aculeatus																						
Bispathodus aculeatus plumulus	1		1		1		1			1	1								6	1	3	41
Bispathodus spinulicostatus																						
Bispathodus ziegleri																						
Clydagnathus cavusformis	4	3	5	3	6	2	4	20	9	8	6	11	2	8	6	27	1	10	10	2	2	201
Clydagnathus gilwernensis																				1		5
Dinodus sp.																						
Gnathodus sp.																						
Hibbardella brevislata																						
Hibbardella? helmsi																						
Hibbardella cf. H. insignis			2			1		2	3			2		2	2		1	4	2	1		23
Hibbardella cf. H. micra	2		2		1			6				3	1	5			2			3		33
Hibbardella (H.) sp. nov. Druce																						
Hindeodella acuta															1					1		3
Hindeodella brevis			1							1												3
Hindeodella corpulenta		1	2	1		3		4	3		1	2					1	1		4		21
Hindeodella subtilis	2	1	2			1	1	1			2		2		2		2			1		21
Hindeodella sp. nov. A			5			1	1		2		1	2	1		4		1		3			26
Hindeodella sp. nov. B																						
Ligonodina platys																						
Neoproniodus cf. N. alatoideus								2					1									3
Neoproniodus alatus	2		2	3	2	4	2		1	3	2			6	3	10		13	2		7	73
Neoproniodus barbatus														1								1
Neoproniodus sp. nov. A																	2					2
Ozarkodina abnormis																						
Ozarkodina flexa								1														1
Ozarkodina cf. O. plana					2					1	1		1	1	2			2	1			13
Ozarkodina rhenana	2	1	1	3			2	1			1			1	2		2	1				24
Ozarkodina sp. A																	2					2
Patrognathus sp. A																						
Polygnathus burtensis																						
Polygnathus communis collinsoni																						
Polygnathus communis communis															1							1
Polygnathus inornatus											1							1		2		10
Polygnathus cf. P. lacinatus																						
Polygnathus thomasi																						1
?Polygnathus sp. A																						
Polygnathus spp.																						
Prioniodina? symmetrica	1					2								2		2						8
Pseudopolygnathus cf. Ps. dentilineatus																						
Pseudopolygnathus multistriatus	3				2				2	1	2						2					14
Pseudopolygnathus cf. Ps. nodomarginatus																						
Siphonodella cf. S. cooperi hassi																						
Siphonodella spp.																						
Spathognathodus acidentatus																			1			2
Spathognathodus canningensis						3	1	2	1			1	1				3		1			14
Spathognathodus crassidentatus			1	1				1	1							1	2		1	9		19
Spathognathodus mehlbrai																						
Spathognathodus cf. S. robustus			2		1	1		2			1	1		1	2		1		1			15
Spathognathodus? sp. nov. A																						
Synprioniodina regularis			3	1													2					9
Gen. et sp. indet. A																						

Table A13.

SAMPLE INTERVAL	1	2	3	4	5	6	7	8		
FORMATION (B Birdseye, G Gumboke, Y Yellow Drum, L Laurel, T Total)	Y →							Y ←		T
Interval dates	X		X		X	X				
I element										
S ₁ element										
Pelekysgnathus australis										
I element										
S ₂ element										
M _{2a} element										
M _{2b} element										
Apparatus A										
P ₁ element										
N element										
S ₃ element										
Sc element										
Sti element										
Acordina sp. A										
Acordina sp. B										
Anchignathodus cristulus								1		1
Anenidius compressa										
Angulodus fasciatus										
Apatognathus sp.										
Bispathodus aculeatus aculeatus										
Bispathodus aculeatus plumulus										
Bispathodus spinulicostatus										
Bispathodus ziegleri										
Clydagnathus cavusformis								1		1
Clydagnathus gilweyensis					2					2
Dmoxius sp.										
Gnathodus sp.										
Hibbardella brevislata										
Hibbardella? helmsi										
Hibbardella cf. H. insignis										
Hibbardella cf. H. micra										
Hibbardella (H.) sp. nov. Druce										
Hindeodella acuta										
Hindeodella brevis										
Hindeodella compuncta										
Hindeodella subtilis										
Hindeodella sp. nov. A										
Hindeodella sp. nov. B										
Ligonodina platys										
Neoprionodus cf. N. alatordeus										
Neoprionodus alatus			1							1
Neoprionodus barhiatus										
Neoprionodus sp. nov. A										
Ozarkodina abnormis										
Ozarkodina flexa										
Ozarkodina cf. O. plana					1					1
Ozarkodina rhenana										
Ozarkodina sp. A										
Patrognathus sp. A										
Polygnathus burtonensis										
Polygnathus communis collinsoni										
Polygnathus communis communis										
Polygnathus inornatus										
Polygnathus cf. P. lacinatus										
Polygnathus thomasi										
?Polygnathus sp. A.										
Polygnathus spp.										
Prioniodina? symmetrica										
Pseudopolygnathus cf. Ps. dentilineatus										
Pseudopolygnathus multistriatus										
Pseudopolygnathus cf. Ps. nodomarginatus										
Siphonodella cf. S. cooperi hassi										
Siphonodella spp.										
Spathognathodus acidentatus										
Spathognathodus canningensis										
Spathognathodus crassidentatus										
Spathognathodus mehlbrai										
Spathognathodus cf. S. robustus										
Spathognathodus? sp. nov. A										
Synprioniodina regularis										
Gen. et sp. indet. A										

Table A14.[illegible]

Table A14 continued.

SAMPLE INTERVAL	17	18	19	20	21	22	23	24	25	26	29	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	T
FORMATION (B = Birdseye; G = Gumhole; Y = Yellow Drum; L = Laurel; T = Total)																	G ←	Y →						Y ←	L	L	
Ictiobon platys			X		X	X			X				X	X	X	X	X	X	X	X	X	X		X	X	X	
I element																											
S ₁ element																											
Pelekygnathus australis																											
I element	1	1		1				2		23		2															40
S ₂ element										9		2															28
M _{2a} element							1			15																	20
M _{2b} element	1							3		9																	23
Apparatus A																											
Pb element																											
N element																											
Sa element																											
Sc element																											
Sb element																											
Acodina sp. A																											
Acodina sp. B																											
Anchignathodus cristulus																											
Angulodus compressa																										1	
Angulodus pergracilis																											
Apatognathus sp.																											
Bispathodus aculeatus aculeatus																											
Bispathodus aculeatus plumulus																											
Bispathodus spinulicostatus																											
Bispathodus ziegleri																											
Clydagnathus cavusformis																											
Clydagnathus gilwernensis																											
Dinodus sp.																											
Gnathodus sp.																											
Hibbardella brevislata																											
Hibbardella? helmsi																											
Hibbardella cf. H. insignis																							1			6	
Hibbardella cf. H. micra																							1			4	
Hibbardella (H.) sp. nov. Druce																											
Hindrodella acuta																											
Hindeodella brevis																										1	
Hindeodella corpulenta																										2	
Hindeodella subtilis																										2	
Hindeodella sp. nov. A																							6			6	
Hindeodella sp. nov. B																										1	
Ligonodina platys																											
Neoproniodus cf. N. alatoideus																											
Neoproniodus alatus																											
Neoproniodus barbatus																											
Neoproniodus sp. nov. A																											
Ozarkodina abnormis																							4			6	
Ozarkodina flexa																											
Ozarkodina cf. O. plana																											
Ozarkodina rhenana																											
Ozarkodina sp. A																											
Patrognathus sp. A																											
Polygnathus burtensis																											
Polygnathus communis collinsoni																										14	
Polygnathus communis communis																											
Polygnathus inornatus																											
Polygnathus cf. P. lacinatus																											
Polygnathus thomasi																											
?Polygnathus sp. A																											
Polygnathus spp.																											
Prioniodina? symmetrica																											
Pseudopolygnathus cf. Ps. dentilineatus																											
Pseudopolygnathus multistriatus																											
Pseudopolygnathus cf. Ps. nodomarginatus																											
Siphonodella cf. S. cooperi hassi																											
Siphonodella spp.																											
Spathognathodus acidentatus																										3	
Spathognathodus canningensis																											
Spathognathodus crassidentatus																											
Spathognathodus mehibrai																										2	
Spathognathodus cf. S. robustus																											
Spathognathodus? sp. nov. A																											
Synprioniodina regularis																							1			6	
Gen. et sp. indet. A																											

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Table A15.

SAMPLE INTERVAL	1	2	3		
FORMATION (B = Birdseye; G = Gumhole; Y = Yellow Drum; L = Laurel; T = Total)	L ↔		L ←		T
<i>Ichneumon platys</i>					
I element					
S ₁ element					
<i>Pelekysgnathus australis</i>					
I element					
S ₂ element					
M _{2a} element					
M _{2b} element					
<i>Apparatus A</i>					
Pb element					
N element					
Sa element					
Sc element					
Sb element					
<i>Acodina</i> sp. A					
<i>Acodina</i> sp. B					
<i>Anchignathodus cristulus</i>		1			1
<i>Anquilorhis compressa</i>					
<i>Angulodus pergracilis</i>					
<i>Apatognathus</i> sp.					
<i>Bispathodus aculeatus aculeatus</i>			1		1
<i>Bispathodus aculeatus plumulus</i>	2	1			3
<i>Bispathodus spinulicostatus</i>					
<i>Bispathodus zieglerei</i>					
<i>Clydagnathus cavusformis</i>	6	1	1		8
<i>Clydagnathus gilwernensis</i>					
<i>Dinodus</i> sp.					
<i>Gnathodus</i> sp.					
<i>Hibbardella brevia lata</i>					
<i>Hibbardella?</i> <i>helmsi</i>					
<i>Hibbardella</i> cf. <i>H. insignis</i>					
<i>Hibbardella</i> cf. <i>H. micra</i>					
<i>Hibbardella</i> (H.) sp. nov. <i>Druce</i>					
<i>Hindeodella acuta</i>					
<i>Hindeodella brevis</i>		1			1
<i>Hindeodella corpulenta</i>			1		1
<i>Hindeodella subtilis</i>					
<i>Hindeodella</i> sp. nov. A					
<i>Hindeodella</i> sp. nov. B					
<i>Ligonodina platys</i>					
<i>Neoproniodus</i> cf. <i>N. alatoideus</i>					
<i>Neoproniodus alatus</i>	1				1
<i>Neoproniodus barbatus</i>					
<i>Neoproniodus</i> sp. nov. A					
<i>Ozarkodina abnormis</i>					
<i>Ozarkodina flexa</i>					
<i>Ozarkodina</i> cf. <i>O. plana</i>	1				1
<i>Ozarkodina rhenana</i>			1		1
<i>Ozarkodina</i> sp. A					
<i>Patrognathus</i> sp. A					
<i>Polygnathus burtensis</i>					
<i>Polygnathus communis collinsoni</i>					
<i>Polygnathus communis communis</i>					
<i>Polygnathus inornatus</i>		1			1
<i>Polygnathus</i> cf. <i>P. lacinatus</i>					
<i>Polygnathus thomasi</i>					
? <i>Polygnathus</i> sp. A.					
<i>Polygnathus</i> spp.		1			1
<i>Prioniodina?</i> <i>symmetrica</i>					
<i>Pseudopolynathus</i> cf. <i>Ps. dentilineatus</i>					
<i>Pseudopolynathus multistriatus</i>					
<i>Pseudopolynathus</i> cf. <i>Ps. nodomarginatus</i>					
<i>Siphonodella</i> cf. <i>S. cooperi hassi</i>					
<i>Siphonodella</i> spp.					
<i>Spathognathodus acidentatus</i>					
<i>Spathognathodus canningensis</i>					
<i>Spathognathodus crassidentatus</i>					
<i>Spathognathodus mehlbrai</i>					
<i>Spathognathodus</i> cf. <i>S. robustus</i>		1			1
<i>Spathognathodus?</i> sp. nov. A					
<i>Synprioniodina regularis</i>					
Gen. et sp. indet. A					

Table A16.

1 G	2 L	3 L		T
	1			1
	1			1
	1	2		3
	11	1		12
	1	1		2
	1	4		5
	3	3		6
	1			1
		2		2
	8	3		11
	2			2
	1			1
	1			1
	3			3
		1		1
	2			2
	2			2
	2			2
1				1
	3			3
	1			1
	1			1
	1			1
1				1

Table A17.

SAMPLE INTERVAL	1	2	6	10	20	30	31	32	33	36	39	46	48	49	51	52	58	62	64		
FORMATION (B = Birdseye; G = Gumhole; Y = Yellow Drum; L = Laurel; T = Total)	L →																		L ←		T
<i>Lonchocera platys</i>			X					X						X			X	X			
I element																					
S ₁ element																					
<i>Pelekysgnathus australis</i>																					
I element																					
S ₂ element																					
M _{2a} element																					
M _{2b} element																					
Apparatus A																					
Pb element					1																1
N element					1						1										2
Sa element						1															1
Sc element					1						1										2
Sb element																					
<i>Acodina</i> sp. A																					
<i>Acodina</i> sp. B																					
<i>Anchignathodus cristulatus</i>	1			1	2																4
<i>Anquilodus compressa</i>	1	1							1		1		1								5
<i>Angulodus pergracilis</i>	1	1									1										3
<i>Apatognathus</i> sp.																					
<i>Bispathodus aculeatus aculeatus</i>		1			3					3											7
<i>Bispathodus aculeatus plumulus</i>	1				3						3					3					10
<i>Bispathodus spinulicostatus</i>																					
<i>Bispathodus ziegleri</i>																					
<i>Clydagnathus cavusformis</i>	1				4				1		2					1	1				10
<i>Clydagnathus gilwernensis</i>																					
<i>Dinodus</i> sp.																					
<i>Gnathodus</i> sp.																					
<i>Hibbardella brevislata</i>																					
<i>Hibbardella?</i> helmsi																					
<i>Hibbardella</i> cf. <i>H. insignis</i>					1											1					2
<i>Hibbardella</i> cf. <i>H. micra</i>					1						1					1					3
<i>Hibbardella</i> (H.) sp. nov. Druce																					
<i>Hindeodella acuta</i>	1																				1
<i>Hindeodella brevis</i>																					
<i>Hindeodella corpulenta</i>						1				1			1								3
<i>Hindeodella subtilis</i>												1									1
<i>Hindeodella</i> sp. nov. A																					
<i>Hindeodella</i> sp. nov. B																					
<i>Ligonodina platys</i>																					
<i>Neoprioniodus</i> cf. <i>N. alatoideus</i>																					
<i>Neoprioniodus alatus</i>		1			1						1							1			4
<i>Neoprioniodus barbatus</i>																					
<i>Neoprioniodus</i> sp. nov. A																					
<i>Ozarkodina abnormis</i>																					
<i>Ozarkodina flexa</i>							1														1
<i>Ozarkodina</i> cf. <i>O. olana</i>									1						1						2
<i>Ozarkodina rhenana</i>							1		1	2											4
<i>Ozarkodina</i> sp. A																					
<i>Patrognathus</i> sp. A																					
<i>Polygnathus burtensis</i>																					
<i>Polygnathus communis collinsoni</i>																					
<i>Polygnathus communis communis</i>																					
<i>Polygnathus inornatus</i>																					
<i>Polygnathus</i> cf. <i>P. lacinatus</i>																					
<i>Polygnathus thomasi</i>											1										1
? <i>Polygnathus</i> sp. A																					
<i>Polygnathus</i> spp.																					
<i>Prioniodina?</i> symmetrica																					
<i>Pseudopolygnathus</i> cf. <i>Ps. dentilineatus</i>																					
<i>Pseudopolygnathus multistriatus</i>																					
<i>Pseudopolygnathus</i> cf. <i>Ps. nodomarginatus</i>																					
<i>Siphonodella</i> cf. <i>S. cooperi hassi</i>																					
<i>Siphonodella</i> spp.																					
<i>Spathognathodus acidentatus</i>																					
<i>Spathognathodus canningensis</i>																					
<i>Spathognathodus crassidentatus</i>						1		1								2					4
<i>Spathognathodus mehlbrai</i>																					
<i>Spathognathodus</i> cf. <i>S. robustus</i>											1										
<i>Spathognathodus?</i> sp. nov. A																					
<i>Synprioniodina regularis</i>								2											1		3
Gen. et sp. indet. A																					

Table A19.[illegible]

Table A20.

SAMPLE INTERVAL	1	2	3	4	5	6	7	8		
FORMATION (B = Birdseye; G = Gumhole; Y = Yellow Drum; L = Laurel; T = Total)	B ↔							B ←		T
<i>Ischnura platys</i>	X	X	X	X	X	X	X	X		
I element										
S ₁ element										
<i>Pelekygnathus australis</i>										
I element										
S ₂ element										
M _{2a} element										
M _{2b} element										
Apparatus A										
Pb element										
N element										
Sa element										
Sc element										
Sb element										
<i>Acodina</i> sp. A										
<i>Acodina</i> sp. B										
<i>Anchignathodus cristulus</i>										
<i>Angulodus compressa</i>										
<i>Angulodus pergracilis</i>										
<i>Apatognathus</i> sp.										
<i>Bispathodus aculeatus aculeatus</i>										
<i>Bispathodus aculeatus plumulus</i>										
<i>Bispathodus spinulicostatus</i>										
<i>Bispathodus ziegleri</i>										
<i>Clydagnathus cavusformis</i>										
<i>Clydagnathus gilwernensis</i>										
<i>Dinodus</i> sp.										
<i>Gnathodus</i> sp.										
<i>Hibbardella brevia lata</i>										
<i>Hibbardella? helmsi</i>										
<i>Hibbardella</i> cf. <i>H. insignis</i>										
<i>Hibbardella</i> cf. <i>H. micra</i>										
<i>Hibbardella</i> (H.) sp. nov. Druce										
<i>Hindeodella acuta</i>										
<i>Hindeodella brevis</i>										
<i>Hindeodella corpulenta</i>										
<i>Hindeodella subtilis</i>										
<i>Hindeodella</i> sp. nov. A										
<i>Hindeodella</i> sp. nov. B										
<i>Ligonodina platys</i>										
<i>Neoprioniodus</i> cf. <i>N. alatoideus</i>										
<i>Neoprioniodus alatus</i>										
<i>Neoprioniodus barbatus</i>										
<i>Neoprioniodus</i> sp. nov. A										
<i>Ozarkodina abnormis</i>										
<i>Ozarkodina flexa</i>										
<i>Ozarkodina</i> cf. <i>O. plana</i>										
<i>Ozarkodina rhenana</i>										
<i>Ozarkodina</i> sp. A										
<i>Patrognathus</i> sp. A										
<i>Polygnathus burtensis</i>										
<i>Polygnathus communis collinsoni</i>										
<i>Polygnathus communis communis</i>										
<i>Polygnathus inornatus</i>										
<i>Polygnathus</i> cf. <i>P. lacinatus</i>										
<i>Polygnathus thomasi</i>										
? <i>Polygnathus</i> sp. A										
<i>Polygnathus</i> spp.										
<i>Prioniodina? symmetrica</i>										
<i>Pseudopolygnathus</i> cf. <i>Ps. dentilineatus</i>										
<i>Pseudopolygnathus multistriatus</i>										
<i>Pseudopolygnathus</i> cf. <i>Ps. nodomarginatus</i>										
<i>Siphonodella</i> cf. <i>S. cooperi</i> Hassi										
<i>Siphonodella</i> spp.										
<i>Spathognathodus acidentatus</i>										
<i>Spathognathodus canningensis</i>										
<i>Spathognathodus crassidentatus</i>										
<i>Spathognathodus mehlbrai</i>										
<i>Spathognathodus</i> cf. <i>S. robustus</i>										
<i>Spathognathodus?</i> sp. nov. A										
<i>Synprioniodina regularis</i>										
Gen. et sp. indet. A										

Table A21.

SAMPLE INTERVAL	1	3	4	5	12	16	17	20	23	27	32	34	35	42	44	46	49	50	51	53	56	58	62	67	69	72	75		
FORMATION (B = Birdseye; G = Gumhole; Y = Yellow Drum; L = Laurel; T = Total)	L →																										L ←	T	
<i>Ichthyos: platys</i>																											x		
I element																													
S ₁ element																													
<i>Pelekysgnathus australis</i>																													
I element																													
S ₂ element																													
M _{2a} element																													
M _{2b} element																													
Apparatus A																													
Pb element																													
N element																													
Sa element																													
Sc element																													
Sb element																													
<i>Acodina</i> sp. A																													
<i>Acodina</i> sp. B																													
<i>Anchignathodus cristulus</i>																	1											1	
<i>Angulorhis compressa</i>								2						1		1	1	3				1	3	2	5			19	
<i>Angulodus pergracilis</i>																	1					1		1				3	
<i>Apatognathus</i> sp.																													
<i>Bispathodus aculeatus aculeatus</i>																	1												
<i>Bispathodus aculeatus plumulus</i>		1		1		1		2		1		1	2	10	10			4				1	2			1		37	
<i>Bispathodus spinulicostatus</i>																													
<i>Bispathodus zieglerei</i>																													
<i>Clydagnathus cavusformis</i>		2	4			4		5	1		1	2		9		4	6	5	2		4	7	4	11	7	11		89	
<i>Clydagnathus gilwernensis</i>	1										1		1		3													5	
<i>Dinodus</i> sp.																													
<i>Gnathodus</i> sp.																													
<i>Hibbardella brevilata</i>																													
<i>Hibbardella?</i> <i>helmsi</i>																													
<i>Hibbardella</i> cf. <i>H. insignis</i>	1																1						2	1				5	
<i>Hibbardella</i> cf. <i>H. micra</i>							1				5		1	1			1				1	3	9	8				30	
<i>Hibbardella</i> (<i>H.</i>) sp. nov. <i>Druce</i>																													
<i>Hindeodella acuta</i>																		1					1					2	
<i>Hindeodella brevis</i>							1																		1			2	
<i>Hindeodella corpulenta</i>		1				2								2	1	1	1				2		7	2	1			20	
<i>Hindeodella subtilis</i>											1		1	1			4	1				4	2	7				21	
<i>Hindeodella</i> sp. nov. A						3					1			3			4	1				2	2		5			21	
<i>Hindeodella</i> sp. nov. B																	1											1	
<i>Ligonodina platys</i>																		2										2	
<i>Neoproniodus</i> cf. <i>N. alatoideus</i>																													2
<i>Neoproniodus alatus</i>		1				3		1			1		2	2	2						5	1	7	9	14			48	
<i>Neoproniodus barbatus</i>																													
<i>Neoproniodus</i> sp. nov. A																								1				1	
<i>Ozarkodina abnormis</i>																													
<i>Ozarkodina flexa</i>																													
<i>Ozarkodina</i> cf. <i>O. plana</i>																	2	1			1		1		1			6	
<i>Ozarkodina rhenana</i>						3						3		2			2	2			1			8	2			22	
<i>Ozarkodina</i> sp. A																													
<i>Patrognathus</i> sp. A																													
<i>Polygnathus burtensis</i>																													
<i>Polygnathus communis collinsoni</i>																													
<i>Polygnathus communis communis</i>																													
<i>Polygnathus inornatus</i>						1												1										2	
<i>Polygnathus</i> cf. <i>P. lacinatus</i>																													
<i>Polygnathus thomasi</i>																													
? <i>Polygnathus</i> sp. A.																													
<i>Polygnathus</i> spp.				1																								1	
<i>Prioniodina?</i> <i>symmetrica</i>			1			1						1						1						3				7	
<i>Pseudopolygnathus</i> cf. <i>Ps. dentilineatus</i>													1										1					1	
<i>Pseudopolygnathus multistriatus</i>																				2								2	
<i>Pseudopolygnathus</i> cf. <i>Ps. nodomarginatus</i>																							1					1	
<i>Siphonodella</i> cf. <i>S. cooperi hassi</i>																													
<i>Siphonodella</i> spp.																													
<i>Spathognathodus acidentatus</i>																													
<i>Spathognathodus canningensis</i>																	2	1						3	6			12	
<i>Spathognathodus crassidentatus</i>														2				3	1				2	3	3			14	
<i>Spathognathodus mehlbrai</i>																													
<i>Spathognathodus</i> cf. <i>S. robustus</i>																			1					3	1			5	
<i>Spathognathodus?</i> sp. nov. A																													
<i>Synprioniodina regularis</i>											2			1		1												4	
Gen. et sp. indet. A																													

Table A22.

SAMPLE INTERVAL	1	2	3		
FORMATION (B = Birdseye; G = Gunhole, Y = Yellow Drum; L = Laurel; T = Total)	G →		G ←		T
<i>Kaliodina platys</i>					
I element					
S ₁ element					
<i>Pelekysgnathus australis</i>					
I element	2	10	3		15
S ₂ element			3		3
M _{2a} element					
M _{2b} element		1			1
Apparatus A					
Pb element					
N element					
Sa element					
Sc element					
Sb element					
<i>Acodina</i> sp. A		1			1
<i>Acodina</i> sp. B					
<i>Anchignathodus cristulus</i>					
<i>Anquilodus compressa</i>			1		1
<i>Angulodus pergracilis</i>		2			2
<i>Apatognathus</i> sp.					
<i>Bispathodus aculeatus aculeatus</i>					
<i>Bispathodus aculeatus plumulus</i>					
<i>Bispathodus spinulicostatus</i>					
<i>Bispathodus zieglerei</i>					
<i>Clydagnathus cavusformis</i>					
<i>Clydagnathus gilwernensis</i>					
<i>Dinodus</i> sp.					
<i>Gnathodus</i> sp.					
<i>Hibbardella brevislata</i>					
<i>Hibbardella?</i> <i>helmsi</i>					
<i>Hibbardella</i> cf. <i>H. insignis</i>					
<i>Hibbardella</i> cf. <i>H. micra</i>		1			1
<i>Hibbardella</i> (H.) sp. nov. Druce		2			2
<i>Hindcodella acuta</i>					
<i>Hindeodella brevis</i>					
<i>Hindeodella corpulenta</i>		1			1
<i>Hindeodella subtilis</i>		11	1		12
<i>Hindeodella</i> sp. nov. A					
<i>Hindeodella</i> sp. nov. B		2			2
<i>Ligonodina platys</i>					
<i>Neoproniodus</i> cf. <i>N. alatoideus</i>					
<i>Neoproniodus alatus</i>					
<i>Neoproniodus barbatus</i>					
<i>Neoproniodus</i> sp. nov. A					
<i>Ozarkodina abnormis</i>		1	4	3	8
<i>Ozarkodina flexa</i>					
<i>Ozarkodina</i> cf. <i>O. plana</i>					
<i>Ozarkodina rhenana</i>					
<i>Ozarkodina</i> sp. A					
<i>Patrognathus</i> sp. A					
<i>Polygnathus burtensis</i>					
<i>Polygnathus communis collinsoni</i>		2	39	13	54
<i>Polygnathus communis communis</i>					
<i>Polygnathus inornatus</i>					
<i>Polygnathus</i> cf. <i>P. lacinatus</i>					
<i>Polygnathus thomasi</i>					
? <i>Polygnathus</i> sp. A.					
<i>Polygnathus</i> spp.					
<i>Prioniodina?</i> <i>symmetrica</i>					
<i>Pseudopolygnathus</i> cf. <i>Ps. dentilineatus</i>					
<i>Pseudopolygnathus multistriatus</i>					
<i>Pseudopolygnathus</i> cf. <i>Ps. nodomarginatus</i>					
<i>Siphonodella</i> cf. <i>S. cooperi hassi</i>					
<i>Siphonodella</i> spp.					
<i>Spathognathodus acidentatus</i>					
<i>Spathognathodus canningensis</i>					
<i>Spathognathodus crassidentatus</i>					
<i>Spathognathodus mehlbrai</i>		3	10	5	18
<i>Spathognathodus</i> cf. <i>S. robustus</i>					
<i>Spathognathodus?</i> sp. nov. A					
<i>Synprioniodina regularis</i>		1	8	2	11
Gen. et sp. indet. A					

Table A23.

SAMPLE INTERVAL	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	28	29	30
FORMATION (B = Birdseye; G = Gumhole;	L																											
Y = Yellow Drum; L = Laurel; T = Total	L																											
<i>Ictiobus platys</i>	x		x		x		x	x	x	x	x	x		x	x		x	x		x		x					x	x
I element																												
S ₁ element																												
<i>Petkysgnathus australis</i>																												
I element																												
S ₂ element																												
M _{2a} element																												
M _{2b} element																												
Apparatus A																												
Plu element																												
N element																								1				
Sa element																												
Sc element																1			1									
Sb element																												
<i>Acodina</i> sp. A																												
<i>Acodina</i> sp. B																												
<i>Anchignathodus cristulus</i>													1											1				
<i>Angulodus compressa</i>																												
<i>Angulodus pergracilis</i>																												
<i>Apatognathus</i> sp.																												
<i>Bispathodus aculeatus aculeatus</i>																												
<i>Bispathodus aculeatus plumulus</i>		2				1																						
<i>Bispathodus spinulicostatus</i>																												
<i>Bispathodus ziegleri</i>																												
<i>Clydagnathus cavusformis</i>																					1				1	1		
<i>Clydagnathus gilwernensis</i>				1		1						2									1			1				
<i>Dinodus</i> sp.																												
<i>Gnathodus</i> sp.																												
<i>Hibbardella brevialeta</i>																												
<i>Hibbardella? helmsi</i>																												
<i>Hibbardella</i> cf. <i>H. insignis</i>																												
<i>Hibbardella</i> cf. <i>H. micra</i>																												
<i>Hibbardella</i> (H.) sp. nov. Druce																												
<i>Hindeodella acuta</i>																												
<i>Hindeodella brevis</i>																												
<i>Hindeodella corpulenta</i>																								1				
<i>Hindeodella subtilis</i>																												
<i>Hindeodella</i> sp. nov. A																												
<i>Hindeodella</i> sp. nov. B																												
<i>Ligonodina platys</i>																												
<i>Neoproniodus</i> cf. <i>N. alatoideus</i>																												
<i>Neoproniodus alatus</i>																												
<i>Neoproniodus barbatus</i>																												
<i>Neoproniodus</i> sp. nov. A																												
<i>Ozarkodina abnormis</i>																												
<i>Ozarkodina flexa</i>																												
<i>Ozarkodina</i> cf. <i>O. plana</i>																												
<i>Ozarkodina rhenana</i>																												
<i>Ozarkodina</i> sp. A																												
<i>Patrognathus</i> sp. A																												
<i>Polygnathus burtensis</i>																												
<i>Polygnathus communis collinsoni</i>																												
<i>Polygnathus communis communis</i>																												
<i>Polygnathus inornatus</i>																												
<i>Polygnathus</i> cf. <i>P. lacinatus</i>																												
<i>Polygnathus thomasi</i>																												
? <i>Polygnathus</i> sp. A.																												
<i>Polygnathus</i> spp.																												
<i>Prioniodina? symmetrica</i>																												
<i>Pseudopolygnathus</i> cf. <i>Ps. dentilineatus</i>																												
<i>Pseudopolygnathus multistriatus</i>																												
<i>Pseudopolygnathus</i> cf. <i>Ps. nodomarginatus</i>																												
<i>Siphonodella</i> cf. <i>S. cooperi hassi</i>																												
<i>Siphonodella</i> spp.																												
<i>Spathognathodus acidentatus</i>																												
<i>Spathognathodus canningensis</i>																												
<i>Spathognathodus crassidentatus</i>																												
<i>Spathognathodus mehlbrai</i>																												
<i>Spathognathodus</i> cf. <i>S. robustus</i>																												
<i>Spathognathodus?</i> sp. nov. A																												
<i>Synprioniodina regularis</i>																												
Gen. et sp. indet. A																												

Table A23 continued.

SAMPLE INTERVAL	31	32	33	44	50	53	54	59	70	78	88	
FORMATION (B = Birdseye, G = Gumhole: Y = Yellow Drum, L = Laurel, T = Total)										L ←		T
Lithologic platys							x					
I element												
S ₁ element												
Pelekygnathus australis												
I element												
S ₂ element												
M _{2a} element												
M _{2b} element												
Apparatus A												
Pb element												
N element												1
Sa element												
Sc element												2
Sb element												
Acodina sp., A												
Acodina sp. B												
Anchignathodus cristulus												2
Angulodus compressa									1	1		2
Angulodus pergracilis											1	1
Apatognathus sp.												
Bispauthodus aculeatus aculeatus												
Bispauthodus aculeatus plumulus			1			1						5
Bispauthodus spinuloscostatus												
Bispauthodus zieglerei												
Clydagnathus cavusformis		1		2			2			2	7	17
Clydagnathus gilwernensis										1		7
Dinodus sp.												
Gnathodus sp.												
Hibbardella brevislata												
Hibbardella? helmsi												
Hibbardella cf. H. insignis										1		1
Hibbardella cf. H. micra												
Hibbardella (H.) sp. nov. Druce												
Himnodella acuta												
Hindeodella brevis							1			1		2
Hindeodella corpulenta												1
Hindeodella subtilis							1					2
Hindeodella sp. nov. A												
Hindeodella sp. nov. B							1					4
Ligonodina platys												
Neoproniodius cf. N. alatoideus												
Neoproniodius alatus							1	1	1			4
Neoproniodius barbatus												
Neoproniodius sp. nov. A												
Ozarkodina abnormis												
Ozarkodina flexa												
Ozarkodina cf. O. plana												
Ozarkodina rhenana												
Ozarkodina sp. A												
Patrognathus sp. A												
Polygnathus burtensis												
Polygnathus communis collinsoni												
Polygnathus communis communis												
Polygnathus inornatus												
Polygnathus cf. P. lacinatus												
Polygnathus thomasi												
?Polygnathus sp. A.												
Polygnathus spp.												
Prioniodina? symmetrica								1				1
Pseudopolygnathus cf. Ps. dentilineatus												1
Pseudopolygnathus multistriatus												4
Pseudopolygnathus cf. Ps. nodomarginatus												
Siphonodella cf. S. cooperi hassi												
Siphonodella spp.												
Spathognathodus aciedeniatius												
Spathognathodus canningensis												4
Spathognathodus crassidentatus												2
Spathognathodus mehlbrai												
Spathognathodus cf. S. robustus												
Spathognathodus? sp. nov. A												
Synprioniodina regularis												
Gen. et sp. inflet. A												

Table A24.[illegible]

Table A25.

SAMPLE INTERVAL	1	22	23	27	28	29	31	32	35	42	43	44	45	49	50	51	52	53	54	55	56	57	58	59	60	61	62	
FORMATION (B = Birdseye; G = Gumhole; Y = Yellow Drum; L = Laurel; T = Total)	L →																											
Location: platys					X	X	X	X	X		X	X	X	X						X	X							
I element																												
S ₁ element																												
Pelekysgnathus australis																												
I element																												
S ₂ element																												
M _{2a} element																												
M _{2b} element																												
Apparatus A																												
Pb element																												
N element																												
Sa element																												
Sc element																												
Sb element																												
Acodina sp. A																												
Acodina sp. B																												
Anchignathodus cristulus																			1						2			
Anquilodus compressa	1		4																1									
Angulodus parvigracilis	1																											
Apatognathus sp.																												
Bispathodus aculeatus aculeatus	2		3																								1	
Bispathodus aculeatus plumulus		1	1							1																		
Bispathodus spinulicostatus	4		5							1									5									
Bispathodus zieglerei																												
Clydagnathus cavusformis	11	6	17							1					1	1	2	3	13			1	9	2	15	3	4	3
Clydagnathus gilwernensis															1													
Dinodus sp.																												
Gnathodus sp.	1																											
Hibbardella brevislata																												
Hibbardella? helmsi																												
Hibbardella cf. H. insignis	3																							1				
Hibbardella cf. H. micra		1	1																					1	2	1		
Hibbardella (H.) sp. nov. Druce																												
Hindeodella acuta																												
Hindeodella brevis																									1			
Hindeodella corpulenta	3																							3				
Hindeodella subtilis																												
Hindeodella sp. nov. A				2															1								1	
Hindeodella sp. nov. B																												
Ligonodina platys																												
Neopriionodus cf. N. alatoideus																												
Neopriionodus alatus	3	1	2											2										2	1		2	
Neopriionodus barbatus																												
Neopriionodus sp. nov. A																												
Ozarkodina abnormis																												
Ozarkodina flexa																												
Ozarkodina cf. O. plana	1		2											3											4			
Ozarkodina rhenana	2		3																1									
Ozarkodina sp. A																												
Patrognathus sp. A																												
Polygnathus burtensis																												
Polygnathus communis collinsoni																												
Polygnathus communis communis				1																								
Polygnathus inornatus				1																								
Polygnathus cf. P. lacinatus																												
Polygnathus thomasi																												
?Polygnathus sp. A.																												
Polygnathus spp.																												
Prioniodina? symmetrica																												
Pseudopolygnathus cf. Ps. dentilineatus																												
Pseudopolygnathus multistriatus																												
Pseudopolygnathus cf. Ps. nodomarginatus																												
Siphonodella cf. S. cooperi hassi																						</						

Table A25 continued.

SAMPLE INTERVAL	63	65	66	67	68	69	70	71	72	73	74	75	76	78	87	88	
FORMATION (B = Birdseye; G = Gumhole; Y = Yellow Drum; L = Laurel; T = Total)																L ←	T
<i>Ligodina platys</i>																	
I element			X												X		
S ₁ element																	
<i>Pelekygnathus australis</i>																	
I element																	
S ₂ element																	
M _{2a} element																	
M _{2b} element																	
Apparatus A																	
Pb element																	
N element																	
Sa element																	
Sc element																	
Sb element																	
<i>Acodina</i> sp. A																	
<i>Acodina</i> sp. B																	
<i>Anchignathodus cristulus</i>	2																2
<i>Anoutodus compressa</i>										1							9
<i>Angulodus pergracilis</i>	1												1				3
<i>Apotognathus</i> sp.																	
<i>Bispathodus aculeatus aculeatus</i>									1	1					1		9
<i>Bispathodus aculeatus plumulus</i>									1							1	5
<i>Bispathodus spinulicostatus</i>																	15
<i>Bispathodus ziegléri</i>																	
<i>Clydagnathus cavusformis</i>	7		1	1	5	4	2		9	4	16	2	12		14	26	201
<i>Clydagnathus gilwernensis</i>										2					3	2	8
<i>Dinodus</i> sp.																	
<i>Gnathodus</i> sp.																	1
<i>Hibbardella brevislata</i>																	
<i>Hibbardella? helmsi</i>																	
<i>Hibbardella</i> cf. <i>H. insignis</i>	1										1				1		7
<i>Hibbardella</i> cf. <i>H. micra</i>																	6
<i>Hibbardella</i> (H.) sp. nov. Druce																	
<i>Hindeodella acuta</i>																	
<i>Hindeodella brevis</i>																	1
<i>Hindeodella corpulenta</i>									1								7
<i>Hindeodella subtilis</i>									1	1					1		3
<i>Hindeodella</i> sp. nov. A									1	1			2		1		9
<i>Hindeodella</i> sp. nov. B																	
<i>Ligodina platys</i>																	
<i>Neoprioniodus</i> cf. <i>N. alatoideus</i>																	
<i>Neoprioniodus alatus</i>	1										1		4			2	21
<i>Neoprioniodus barbatus</i>																	
<i>Neoprioniodus</i> sp. nov. A																	
<i>Ozarkodina abnormis</i>																	
<i>Ozarkodina flexa</i>																	
<i>Ozarkodina</i> cf. <i>O. plana</i>	2								1		1		1			1	16
<i>Ozarkodina rhenana</i>										2	2				1		11
<i>Ozarkodina</i> sp. A																	
<i>Patrognathus</i> sp. A																	
<i>Polygnathus burtensis</i>														1			1
<i>Polygnathus communis collinsoni</i>																	
<i>Polygnathus communis communis</i>																	1
<i>Polygnathus inornatus</i>																	1
<i>Polygnathus</i> cf. <i>P. lacinatus</i>																	
<i>Polygnathus thomasi</i>																	
? <i>Polygnathus</i> sp. A																	
<i>Polygnathus</i> spp.																	
<i>Prioniodina? symmetrica</i>	1																1
<i>Pseudopolygnathus</i> cf. <i>Ps. dentilineatus</i>	1									4		2	4		10	4	25
<i>Pseudopolygnathus multistriatus</i>																	
<i>Pseudopolygnathus</i> cf. <i>Ps. nodomarginatus</i>																	
<i>Siphonodella</i> cf. <i>S. cooperi hassi</i>																	
<i>Siphonodella</i> spp.																	
<i>Spathognathodus acidentatus</i>																	
<i>Spathognathodus canningensis</i>									2	2	2	2	7				14
<i>Spathognathodus crassidentatus</i>	1												4				8
<i>Spathognathodus mehlbrai</i>																	
<i>Spathognathodus</i> cf. <i>S. robustus</i>															2		3
<i>Spathognathodus?</i> sp. nov. A																	
<i>Synprioniodina regularis</i>				1													2
Gen. et sp. indet. A																	

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Table A26.

SAMPLE INTERVAL	1	3	4	12	13	15	16	17	18	19	20	21	23	25	29	30	32	34	37	38	39	41	42	44	45	
FORMATION (B - Birdseye; G - Gumhole; Y = Yellow Drum; L - Laurel; T Total)	L ↳																								L ←	T.
Ligonodina platys					X	X			X	X	X	X	X	X		X		X	X	X		X		X	X	
I element					X	X			X	X	X	X	X	X		X		X	X	X		X		X	X	
S ₁ element																										
Pelekysgnathus australis																										
I element																										
S ₂ element																										
M _{2a} element																										
M _{2b} element																										
Apparatus A																										
Pb element																	1									1
N element															1							1				2
Sa element																	1			1						2
Sc element																						4				4
Sb element																	1					2			2	5
Acodina sp. A																										
Acodina sp. B																										
Anchignathodus cristulus							1							4								3				8
Annulindus compressa																										
Angulodus pergracilis																						1				1
Apatognathus sp.																										
Bispathodus aculeatus aculeatus																										
Bispathodus aculeatus plumulus																						14				14
Bispathodus spinulicostatus																										
Bispathodus ziegleri																										
Clydagnathus cavusformis																										
Clydagnathus gilwernensis	1	2	5			1								4		2										15
Dinodus sp.																										
Gnathodus sp.																										
Hibbardella brevislata																										
Hibbardella? helmsi																										
Hibbardella cf. H. insignis																					1				1	2
Hibbardella cf. H. micra																										
Hibbardella (H.) sp. nov. Druce																										
Hindeodella acuta																										
Hindeodella brevis																						1				1
Hindeodella corpulenta			1														1				1					3
Hindeodella subtilis																								1		1
Hindeodella sp. nov. A														2						1						3
Hindeodella sp. nov. B																										
Ligonodina platys																										
Neoprioniodus cf. N. alatoideus																										
Neoprioniodus alatus														2												2
Neoprioniodus barbatus																										
Neoprioniodus sp. nov. A																										
Ozarkodina abnormis																										
Ozarkodina flexa																										
Ozarkodina cf. O. plana														2												2
Ozarkodina rhenana																						1				1
Ozarkodina sp. A																										
Patrognathus sp. A																										
Polygnathus burtensis																										
Polygnathus communis collinsoni																										
Polygnathus communis communis																										
Polygnathus inornatus																										
Polygnathus cf. P. lacinatus																										
Polygnathus thomasi																										
?Polygnathus sp. A.																										
Polygnathus spp.																										
Prioniodina? symmetrica																						1				1
Pseudopolygnathus cf. Ps. dentilineatus																										
Pseudopolygnathus multistriatus																										
Pseudopolygnathus cf. Ps. nodomarginatus																										
Siphonodella cf. S. cooperi hassi																										
Siphonodella spp.																										
Spathognathodus acidentatus																										
Spathognathodus canningensis																										
Spathognathodus crassidentatus																										
Spathognathodus mehlbrai																										
Spathognathodus cf. S. robustus																										
Spathognathodus? sp. nov. A																										
Synprioniorlina regularis		1																								1
Gen. et sp. inclct. A																										

Table A27.

SAMPLE INTERVAL	1	2	3	4	5	6	7	8	9	10	11	12	
FORMATION (B = Birdseye; G = Gumbo; L = Laurel; T = Total)	G											G	T
Y = Yellow Drum; L = Laurel; T = Total	→											←	
<i>Ichthyodonta platys</i>	x	x	x			x	1	1					2
I element													
S ₁ element													
<i>Pelekysgnathus australis</i>								1			2		3
I element								1			1		3
S ₂ element				1				1			1		3
M _{2a} element								1					1
M _{2b} element					1		4	1	1		1	1	9
<i>Apparatus A</i>													
Pb element													
N element													
Sa element													
Sc element													
Sb element													
<i>Acodina</i> sp. A													
<i>Acodina</i> sp. B											1		1
<i>Anchignathodus cristulus</i>													
<i>Angulodus compressa</i>					1				1		2		4
<i>Angulodus pergracilis</i>													
<i>Apatognathus</i> sp.													
<i>Bispathodus aculeatus aculeatus</i>													
<i>Bispathodus aculeatus plumulus</i>													
<i>Bispathodus spirulicostatus</i>													
<i>Bispathodus zieglerei</i>													
<i>Clydagnathus cavusformis</i>													
<i>Clydagnathus gilwernensis</i>													
<i>Dinodus</i> sp.													
<i>Gnathodus</i> sp.													
<i>Hibbardella brevislata</i>													
<i>Hibbardella? helmsi</i>													
<i>Hibbardella</i> cf. <i>H. insignis</i>								1					1
<i>Hibbardella</i> cf. <i>H. micra</i>													
<i>Hibbardella</i> (H.) sp. nov. Druce											1		1
<i>Hindeodella acuta</i>													
<i>Hindeodella brevis</i>								2					2
<i>Hindeodella corpulenta</i>				1				1					2
<i>Hindeodella subtilis</i>													
<i>Hindeodella</i> sp. nov. A													
<i>Hindeodella</i> sp. nov. B													
<i>Ligonodina platys</i>													
<i>Neopriodontus</i> cf. <i>N. alatoideus</i>													
<i>Neopriodontus alatus</i>													
<i>Neopriodontus barbatus</i>													
<i>Neopriodontus</i> sp. nov. A													
<i>Ozarkodina abnormis</i>								2					2
<i>Ozarkodina flexa</i>													
<i>Ozarkodina</i> cf. <i>O. plana</i>													
<i>Ozarkodina rhenana</i>													
<i>Ozarkodina</i> sp. A													
<i>Patrognathus</i> sp. A													
<i>Polygnathus burtensis</i>													
<i>Polygnathus communis collinsoni</i>													
<i>Polygnathus communis communis</i>													
<i>Polygnathus inornatus</i>													
<i>Polygnathus</i> cf. <i>P. lacinatus</i>													
<i>Polygnathus thomasi</i>													
? <i>Polygnathus</i> sp. A.													
<i>Polygnathus</i> spp.													
<i>Prionodina? symmetrica</i>				1				1					2
<i>Pseudopolygnathus</i> cf. <i>Ps. dentilineatus</i>													
<i>Pseudopolygnathus multistriatus</i>													
<i>Pseudopolygnathus</i> cf. <i>Ps. nodomarginatus</i>													
<i>Siphonodella</i> cf. <i>S. cooperi hassi</i>													
<i>Siphonodella</i> spp.													
<i>Spathognathodus acidentatus</i>				4				1	1				6
<i>Spathognathodus canningensis</i>													
<i>Spathognathodus crassidentatus</i>													
<i>Spathognathodus mehlbrai</i>									1				1
<i>Spathognathodus</i> cf. <i>S. robustus</i>													
<i>Spathognathodus?</i> sp. nov. A													
<i>Synprionodina regularis</i>										1			1
Gen. et sp. indet. A													

Table A28.

SAMPLE INTERVAL	1	3	6	7	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	
FORMATION (B = Birdseye; G = Gumhole; Y = Yellow Drum; L = Laurel; T = Total)	G →																									G ←	T
Ligonodina platys	x								x			x											1	x			
I element																											1
S ₁ element																											
Pelekysgnathus australis																											
I element		6		2		10	1				1			4						1		1					26
S ₂ element											1			1													2
M _{2a} element				2	1																1						4
M _{2b} element		4	1				1	1																			7
Apparatus A																											
Pb element																											
N element																											
Sa element																											
Sc element																											
Sb element																											
Acodina sp. A		1	1	1						1											1						5
Acodina sp. B																											
Anchignathodus cristulatus																											
Annulodius compressa					1	1																					2
Angulodus pergracilis		1																									1
Apatognathus sp.																											
Bispathodus aculeatus aculeatus																											
Bispathodus aculeatus plumulus																											
Bispathodus spinulicostatus																											
Bispathodus ziegleri																											
Clydagnathus cavusformis																											
Clydagnathus gilwernensis																											
Dinodus sp.																											
Gnathodus sp.																											
Hibbardella brevislata																											
Hibbardella? helmsi																											
Hibbardella cf. H. insignis							1										1	1							3		6
Hibbardella cf. H. micra		2		2										1													5
Hibbardella (H.) sp. nov. Druce																				1				2			3
Hindeodella acuta																											
Hindeodella brevis							1																				1
Hindeodella corpulenta		1		1									1	3	1												7
Hindeodella subtilis		5		4						1														1			11
Hindeodella sp. nov. A																					1						1
Hindeodella sp. nov. B		1																									1
Ligonodina platys																											
Neoproniodus cf. N. alatoideus																											
Neoproniodus alatus																											
Neoproniodus barbatus																											
Neoproniodus sp. nov. A																											
Ozarkodina abnormis			5		3									2	1										3		14
Ozarkodina flexa																											
Ozarkodina cf. O. plana																											
Ozarkodina rhenana																											
Ozarkodina sp. A																											
Patrognathus sp. A																											
Polygnathus burtensis																											
Polygnathus communis collinsoni																											
Polygnathus communis communis																											
Polygnathus inornatus																											
Polygnathus cf. P. lacinatus																											
Polygnathus thomasi																											
?Polygnathus sp. A.																											
Polygnathus spp.																											
Prioniodina? symmetrica		1												1			1						1	1			5
Pseudopolygnathus cf. Ps. dentilineatus																											
Pseudopolygnathus multistriatus																											
Pseudopolygnathus cf. Ps. nodomarginatus																											
Siphonodella cf. S. cooperi hassi																											
Siphonodella spp.																											
Spathognathodus acidentatus		9		3	3									7		2	1	2		1			1		5		34
Spathognathodus canningensis																											
Spathognathodus crassidentatus					1																						1
Spathognathodus mehlbrai														1									1		1		3
Spathognathodus cf. S. robustus																											
Spathognathodus? sp. nov. A																											
Synprioniodina regularis		4	3	4	2									7	1					2	2	1	1				27
Gen. et sp. indet. A																											

Table A29.

SAMPLE INTERVAL	1
FORMATION (B = Birdseye; G = Gumhole; Y = Yellow Drum; L = Laurel; T = Total)	G
Lithology: platys	
I element	
S ₁ element	
Pelekysgnathus australis	
I element	
S ₂ element	
M _{2a} element	
M _{2b} element	3
Apparatus A	
Pb element	
N element	
Sa element	
Sc element	
Sb element	
Acodina sp. A	
Acodina sp. B	
Anchignathodus cristulus	
Angulodus compressa	
Angulodus pergracilis	
Apatognathus sp.	
Bispathodus aculeatus aculeatus	
Bispathodus aculeatus plumulus	
Bispathodus spinulicostatus	
Bispathodus zieglerei	
Clydagnathus cavusformis	
Clydagnathus giwernensis	
Dinodus sp.	
Gnathodus sp.	
Hibbardella brevialata	
Hibbardella? helmsi	
Hibbardella cf. H. insignis	
Hibbardella cf. H. micro	
Hibbardella (H.) sp. nov. Druce	
Hindeodella acuta	
Hindeodella brevis	
Hindeodella corpulenta	
Hindeodella subtilis	
Hindeodella sp. nov. A	
Hindeodella sp. nov. B	
Ligonodina platys	
Neoproniodus cf. N. alatoideus	
Neoproniodus alatus	
Neoproniodus barbatus	
Neoproniodus sp. nov. A	
Ozarkodina abnormis	
Ozarkodina flexa	
Ozarkodina cf. O. plana	
Ozarkodina rhenana	
Ozarkodina sp. A	
Patrognathus sp. A	
Polygnathus burtensis	
Polygnathus communis collinsoni	1
Polygnathus communis communis	
Polygnathus inornatus	
Polygnathus cf. P. lacinatus	
Polygnathus thomasi	
?Polygnathus sp. A.	
Polygnathus spp.	
Prioniodina? symmetrica	
Pseudopolygnathus cf. Ps. dentilineatus	
Pseudopolygnathus multistriatus	
Pseudopolygnathus cf. Ps. nodomarginatus	
Siphonodella cf. S. cooperi hassi	
Siphonodella spp.	
Spathognathodus acidentatus	1
Spathognathodus canningensis	
Spathognathodus crassidentatus	2
Spathognathodus mehlbrai	
Spathognathodus cf. S. robustus	
Spathognathodus? sp. nov. A	
Synprioniodina regularis	
Gen. et sp. indet. A	

Table A30.[illegible]**Table A31.**[illegible]

Table A32.

SAMPLE INTERVAL	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	
FORMATION (B = Birdseye; G = Gumhole; Y = Yellow Drum; L = Laurel; T = Total)	G ↪																													G ↔	T
Ichthyofauna platys												x	x								x	x					x		x	x	
I element																															
S ₁ element																															
Pelekysgnathus australis																															
I element	1	2	1	1	1	5		6	4	3	1						2	1										2			30
S ₂ element	1			1		5	1	2	4		1					1		1					1					3			21
M _{2a} element					2		1		1					1														1			6
M _{2b} element	1		1		1										1										1						5
Apparatus A																															
Pb element																															
N element																															
Sa element																															
Sc element																															
Sb element																															
Acodina sp. A															1																1
Acodina sp. B																															
Anchignathodus cristulus																					1										1
Angulodus compressa																															
Angulodus pergracilis																															
Apatognathus sp.																															
Bispathodus aculeatus aculeatus																															
Bispathodus aculeatus plumulus																															
Bispathodus spinulicostatus																															
Bispathodus zieglerei																															
Clydagnathus cavusformis																															
Clydagnathus gilwernensis																															
Dinodus sp.																															
Gnathodus sp.																															
Hibbardella brevislata																															
Hibbardella? helmsi																															
Hibbardella cf. H. insignis						1			1															1							3
Hibbardella cf. H. micra								1		2														1							4
Hibbardella (H.) sp. nov. Druce																															
Hindeodella acuta																															
Hindeodella brevis									1	1																					2
Hindeodella corpulenta	1					2																									3
Hindeodella subtilis																															
Hindeodella sp. nov. A																															
Hindeodella sp. nov. B																															
Ligonodina platys																															
Neoproniodus cf. N. alatoideus																															
Neoproniodus alatus																															
Neoproniodus barbatus																															
Neoproniodus sp. nov. A																															
Ozarkodina abnormis																					1										1
Ozarkodina flexa																															
Ozarkodina cf. O. plana																															
Ozarkodina rhenana																															
Ozarkodina sp. A																															
Patrognathus sp. A																															
Polygnathus burtensis																															
Polygnathus communis collinsoni						5			1																						6
Polygnathus communis communis																															
Polygnathus inornatus																															
Polygnathus cf. P. lacinatus																															
Polygnathus thomasi																															
?Polygnathus sp. A.																															
Polygnathus spp.																															
Prioniodina? symmetrica																1															1
Pseudopolygnathus cf. Ps. dentilineatus																															
Pseudopolygnathus multistriatus																															
Pseudopolygnathus cf. Ps. nodomarginatus																															
Siphonodella cf. S. cooperi hassi																															
Siphonodella spp.																															
Spathognathodus acidentatus					1	1								2	2	2		1	1							1	2				13
Spathognathodus canningensis																															
Spathognathodus crassidentatus					1																										1
Spathognathodus mehlbrai										1																					1
Spathognathodus cf. S. robustus																															
Spathognathodus? sp. nov. A																															
Synprioniodina regularis					1	1				1							1														4
Gen. et sp. indet. A																															

Table A33.[illegible]

Table A34.

SAMPLE INTERVAL	1	2	3	4	5	6	7	8	
FORMATION (B = Birdseye; G = Gumhole; Y = Yellow Drum; L = Laurel; T = Total)	B →							B ←	T
Iciodius platys	x	x	x	x	x	x	x		
I element									
S ₁ element									
Pelekysgnathus australis									
I element								2	2
S ₂ element								1	1
M _{2a} element									
M _{2b} element								1	1
Apparatus A									
Pb element									
N element									
Sa element									
Sc element									
Sb element									
Acodina sp. A									
Acodina sp. B									
Anchignathodus cristulus									
Angulodus compressa									
Angulodus pergracilis									
Apatognathus sp.									
Bispathodus aculeatus aculeatus									
Bispathodus aculeatus plumulus									
Bispathodus spinulicostatus									
Bispathodus zieglerei									
Clydagnathus cavusformis									
Clydagnathus gilwernensis									
Dinodus sp.									
Gnathodus sp.									
Hibbardella brevislata									
Hibbardella? helmsi									
Hibbardella cf. H. insignis									
Hibbardella cf. H. micra									
Hibbardella (H.) sp. nov. Druce									
Hindeodella acuta									
Hindeodella brevis									
Hindeodella corpulenta									
Hindeodella subtilis									
Hindeodella sp. nov. A									
Hindeodella sp. nov. B									
Ligonodina platys									
Neopriionodus cf. N. alatoideus									
Neopriionodus alatus									
Neopriionodus barbatus									
Neopriionodus sp. nov. A									
Ozarkodina abnormis									
Ozarkodina flexa									
Ozarkodina cf. O. plana									
Ozarkodina rhenana									
Ozarkodina sp. A									
Patrognathus sp. A									
Polygnathus burtensis									
Polygnathus communis collinsoni									
Polygnathus communis communis									
Polygnathus inornatus									
Polygnathus cf. P. lacinatus									
Polygnathus thomasi									
?Polygnathus sp. A.									
Polygnathus spp.									
Prioniodina? symmetrica									
Pseudopolygnathus cf. Ps. dentilineatus									
Pseudopolygnathus multistriatus									
Pseudopolygnathus cf. Ps. nodomarginatus									
Siphonodella cf. S. cooperi hassi									
Siphonodella spp.								1	1
Spathognathodus acidentatus									
Spathognathodus canningensis									
Spathognathodus crassidentatus									
Spathognathodus mehlbrai									
Spathognathodus cf. S. robustus									
Spathognathodus? sp. nov. A									
Synpriioniodina regularis									
Gen. et sp. indet. A									

Table A35.[illegible]

Table A36.

SAMPLE INTERVAL	1	2	3	4	5	6	7	10	11		
FORMATION (B = Birdseye; G = Gumhole, Y = Yellow Drum; L = Laurel; T = Total)	B	B	G →						G ←		T
Interstrat. platys											
I element			4	6	23	x	x	x			33
S ₁ element			1								1
Pelekysgnathus australis											
I element	8		1	1	6				1		17
S ₂ element					3						3
M _{2a} element	6		1	1	4						12
M _{2b} element	5		1	11							17
Apparatus A											
Pb element											
N element											
Sa element											
Sc element											
Sb element											
Acodina sp. A											
Acodina sp. B											
Anchignathodus cristulus											
Anaulodus compressa	1				1						2
Angulodus pergracilis											
Apatognathus sp.											
Bispathodus aculeatus aculeatus											
Bispathodus aculeatus plumulus											
Bispathodus spinulicostatus											
Bispathodus ziegleri											
Clydagnathus cavusformis											
Clydagnathus gilwernensis											
Dinodus sp.											
Gnathodus sp.											
Hibbardella brevialata											
Hibbardella? helmsi											
Hibbardella cf. H. insignis											
Hibbardella cf. H. micra											
Hibbardella (H.) sp. nov. Druce											
Hindeodella acuta											
Hindeodella brevis											
Hindeodella corpulenta			1		2						3
Hindeodella subtilis	2				4						6
Hindeodella sp. nov. A											
Hindeodella sp. nov. B					1						1
Ligonodina platys											
Neoprioniodus cf. N. alatoideus											
Neoprioniodus alatus											
Neoprioniodus barbatus											
Neoprioniodus sp. nov. A											
Ozarkodina abnormis	1										1
Ozarkodina flexa											
Ozarkodina cf. O. plana											
Ozarkodina rhenana											
Ozarkodina sp. A											
Patrognathus sp. A											
Polygnathus burtensis											
Polygnathus communis collinsoni											
Polygnathus communis communis											
Polygnathus inornatus											
Polygnathus cf. P. lacinatus											
Polygnathus thomasi											
?Polygnathus sp. A.											
Polygnathus spp.											
Prioniodina? symmetrica											
Pseudopolygnathus cf. Ps. dentilineatus											
Pseudopolygnathus multistriatus											
Pseudopolygnathus cf. Ps. nodomarginatus											
Siphonodella cf. S. cooperi hassi											
Siphonodella spp.											
Spathognathodus acidentatus	4				5						9
Spathognathodus canningensis											
Spathognathodus crassidentatus	4				2						6
Spathognathodus mehlbrai	1										1
Spathognathodus cf. S. robustus											
Spathognathodus? sp. nov. A	11										11
Synprioniodina regularis	4				5						9
Gen. et sp. indet. A			1								1

Table A37.[illegible]

Table A39.128

Table A41.

SAMPLE INTERVAL	1	2	3	8	9	10	11	12	
FORMATION (B = Birdseye; G = Gumhole; Y = Yellow Drum; L = Laurel; T = Totall ice core data)	B	G ↔						G ↔	T
I element	x	x		x	1	x			1
S ₁ element									
Pelekysgnathus australis									
I element			2		1				3
S ₂ element			5						5
M _{2a} element			3	1					4
M _{2b} element			3		3				6
Apparatus A									
Pb element									
N element									
Sa element									
Sc element									
Sb element									
Acodina sp. A									
Acodina sp. B									
Anchignathodus cristulus									
Anquitolus compressa									
Angulodus pergracilis									
Apatognathus sp.									
Bispathodus aculeatus aculeatus									
Bispathodus aculeatus plumulus									
Bispathodus spinulicostatus									
Bispathodus ziegleri									
Clydagnathus cavusformis									
Clydagnathus gilwernensis									
Dinodus sp.									
Gnathodus sp.									
Hibbardella brevialata									
Hibbardella? helmsi									
Hibbardella cf. H. insignis					3			2	5
Hibbardella cf. H. micra									
Hibbardella (H.) sp. nov. Druce									
Hindeodella acuta									
Hindeodella brevis									
Hindeodella corpulenta					1				1
Hindeodella subtilis									
Hindeodella sp. nov. A									
Hindeodella sp. nov. B									
Ligonodina platys									
Neoproniodus cf. N. alatoideus									
Neoproniodus alatus									
Neoproniodus barbatus									
Neoproniodus sp. nov. A									
Ozarkodina abnormis				1					1
Ozarkodina flexa									
Ozarkodina cf. O. plana									
Ozarkodina rhenana									
Ozarkodina sp. A									
Patrognathus sp. A									
Polygnathus burtensis									
Polygnathus communis collinsoni									
Polygnathus communis communis									
Polygnathus inornatus									
Polygnathus cf. P. lacinatus									
Polygnathus thomasi									
?Polygnathus sp. A.									
Polygnathus spp.									
Prioniodina? symmetrica				1		2		2	2
Pseudopolygnathus cf. Ps. dentilineatus									
Pseudopolygnathus multistriatus									
Pseudopolygnathus cf. Ps. nodomarginatus									
Siphonodella cf. S. cooperi hassi									
Siphonodella spp.									
Spathognathodus acidentatus			5		4		1	1	11
Spathognathodus canningensis									
Spathognathodus crassidentatus					3		1		4
Spathognathodus mehlbrai							1		1
Spathognathodus cf. S. robustus									
Spathognathodus? sp. nov. A									
Synprioniodina regularis			1		2		1		4
Gen. et sp. indet. A									

[illegible]

Table A42.

SAMPLE INTERVAL	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	
FORMATION (B = Birdseye; G = Gumhole; Y = Yellow Drum; L = Laurel; T = Total)	L	Y															Y	T
		↔															↔	
<i>Ictiurus platys</i>								X	X			X	X		X	X	X	
I element																		
S ₁ element																		
<i>Pelekygnathus australis</i>																		
I element																		
S ₂ element																		
M _{2a} element																		
M _{2b} element																		
Apparatus A																		
Pb element																		
N element																		
Sa element																		
Sc element																		
Sb element																		
<i>Acodina</i> sp. A																		
<i>Acodina</i> sp. B																		
<i>Anchignathodus cristulus</i>																		
<i>Angulodus compressa</i>																		
<i>Angulodus pergracilis</i>																		
<i>Apatognathus</i> sp.																		
<i>Bispathodus aculeatus aculeatus</i>																		
<i>Bispathodus aculeatus plumulus</i>				1						2				1				4
<i>Bispathodus spinulicostatus</i>																		
<i>Bispathodus zieglerei</i>																		
<i>Clydagnathus cavusiformis</i>																		
<i>Clydagnathus gilwernensis</i>	4			3														7
<i>Dinodus</i> sp.																		
<i>Gnathodus</i> sp.																		
<i>Hibbardella brevislata</i>																		
<i>Hibbardella?</i> helmsi																		
<i>Hibbardella</i> cf. <i>H. insignis</i>	1																	1
<i>Hibbardella</i> cf. <i>H. micra</i>																		
<i>Hibbardella</i> (H.) sp. nov. Druce																		
<i>Hindeodella acuta</i>																		
<i>Hindeodella brevis</i>																		
<i>Hindeodella corpulenta</i>	1									1								2
<i>Hindeodella subtilis</i>																		
<i>Hindeodella</i> sp. nov. A																		
<i>Hindeodella</i> sp. nov. B																		
<i>Ligonodina platys</i>																		
<i>Neoproniodus</i> cf. <i>N. alatoideus</i>																		
<i>Neoproniodus alatus</i>		1					2											3
<i>Neoproniodus barbatus</i>																		
<i>Neoproniodus</i> sp. nov. A																		
<i>Ozarkodina abnormis</i>																		
<i>Ozarkodina flexa</i>																		
<i>Ozarkodina</i> cf. <i>O. plana</i>																		
<i>Ozarkodina rhenana</i>																		
<i>Ozarkodina</i> sp. A																		
<i>Patrogynathus</i> sp. A										1	1							2
<i>Polygnathus burtensis</i>																		
<i>Polygnathus communis collinsoni</i>																		
<i>Polygnathus communis communis</i>																		
<i>Polygnathus inornatus</i>																		
<i>Polygnathus</i> cf. <i>P. lacinatus</i>																		
<i>Polygnathus thomasi</i>																		
? <i>Polygnathus</i> sp. A.										1								1
<i>Polygnathus</i> spp.																		
<i>Prioniodina?</i> symmetrica																		
<i>Pseudopolygnathus</i> cf. <i>Ps. dentilineatus</i>					1	4	5			1								11
<i>Pseudopolygnathus multistriatus</i>																		
<i>Pseudopolygnathus</i> cf. <i>Ps. nodomarginatus</i>																		
<i>Siphonodella</i> cf. <i>S. cooperi hassi</i>																		
<i>Siphonodella</i> spp.																		
<i>Spathognathodus acedentatus</i>																		
<i>Spathognathodus canningensis</i>																		
<i>Spathognathodus crassidentatus</i>																		
<i>Spathognathodus mehlbrai</i>																		
<i>Spathognathodus</i> cf. <i>S. robustus</i>																		
<i>Spathognathodus?</i> sp. nov. A																		
<i>Synprioniodina regularis</i>																		
Gen. et sp. indet. A																		

Table A43.

SAMPLE INTERVAL	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	
FORMATION (B = Birdseye, G = Gumhole; Y = Yellow Drum; L = Laurel; T = Total)	L ↳																							L ←	
<i>Ichthyura platys</i>																									T
I element																									
S ₁ element																									
<i>Pelekygnathus australis</i>																									
I element																									
S ₂ element																									
M _{2a} element																									
M _{2b} element																									
Apparatus A																									
Pb element																									
N element																									
Sa element																									
Sc element																									
Sb element																									
<i>Acodina</i> sp. A																									
<i>Acodina</i> sp. B																									
<i>Anchignathodus cristulus</i>																									
<i>Anaulodus compressa</i>	3			1																					4
<i>Angulodus pergracilis</i>																									
<i>Apatognathus</i> sp.																									
<i>Bispathodus aculeatus aculeatus</i>	1				1	1				2							3			2	6		4	1	21
<i>Bispathodus aculeatus plumulus</i>																									
<i>Bispathodus spinulicostatus</i>																									
<i>Bispathodus zieglerei</i>																									
<i>Clydagnathus cavusformis</i>	98	2	7	16	18	12	8	7	16	7	4	2	2	5	8	14	4	9	1	8	5	4	5	1	163
<i>Clydagnathus gilwernensis</i>									1									1							2
<i>Dinodus</i> sp.																									
<i>Gnathodus</i> sp.																									
<i>Hibbardella brevialata</i>																									
<i>Hibbardella? helmsi</i>																									
<i>Hibbardella</i> cf. <i>H. insignis</i>	4		2		3		1								1		1			2					14
<i>Hibbardella</i> cf. <i>H. micra</i>	2		4	3											2		1	1			1		2		16
<i>Hibbardella</i> (H.) sp. nov. Druce																									
<i>Hindeodella acuta</i>																									
<i>Hindeodella brevis</i>	1																			1					2
<i>Hindeodella corpulenta</i>					1		2																		3
<i>Hindeodella subtilis</i>					3		5								1										9
<i>Hindeodella</i> sp. nov. A																									
<i>Hindeodella</i> sp. nov. B																									
<i>Ligonodina platys</i>																									
<i>Neoproniodus</i> cf. <i>N. alatoideus</i>																									
<i>Neoproniodus alatus</i>	8			1	4	5	4			1						4	1	3		3	3				37
<i>Neoproniodus barbatus</i>																									
<i>Neoproniodus</i> sp. nov. A																									
<i>Ozarkodina abnormis</i>																									
<i>Ozarkodina flexa</i>																									
<i>Ozarkodina</i> cf. <i>O. plana</i>	4		3	4		5				1						2									19
<i>Ozarkodina rhenana</i>																	1								1
<i>Ozarkodina</i> sp. A																									
<i>Patrognathus</i> sp. A																									
<i>Polygnathus burtensis</i>																									
<i>Polygnathus communis collinsoni</i>																									
<i>Polygnathus communis communis</i>																									
<i>Polygnathus inornatus</i>																						1	1		2
<i>Polygnathus</i> cf. <i>P. lacinatus</i>																									
<i>Polygnathus thomasi</i>																									
? <i>Polygnathus</i> sp. A																									
<i>Polygnathus</i> spp.																									
<i>Prioniodina? symmetrica</i>	4		2																			1	1		8
<i>Pseudopolygnathus</i> cf. <i>Ps. dentilineatus</i>	22		3	5	3		1		1	1						2						3			41
<i>Pseudopolygnathus multistriatus</i>										1															1
<i>Pseudopolygnathus</i> cf. <i>Ps. nodomarginatus</i>																									
<i>Siphonodella</i> cf. <i>S. cooperi</i> Hassi																									
<i>Siphonodella</i> spp.																									
<i>Spathognathodus acidentatus</i>																									
<i>Spathognathodus canningensis</i>	7		4	11																					22
<i>Spathognathodus crassidentatus</i>						1	5	7			1	1													15
<i>Spathognathodus mehlbrai</i>																									
<i>Spathognathodus</i> cf. <i>S. robustus</i>																									
<i>Spathognathodus?</i> sp. nov. A																									
<i>Synprioniodina regularis</i>																									
Gen. et sp. indet. A																									

Table A44.

SAMPLE INTERVAL	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	
FORMATION (B = Birdseye; G = Gumhole; Y = Yellow Drum; L = Laurel; T = Total)	Y →																				Y ←		T
Icterus platys		x	x	x	x	x	x	x						x	x	x	x		x	x	x		
I element																							
S ₁ element																							
Pelekysgnathus australis																							
I element																						2	2
S ₂ element																							
M ₂₅ element																						1	1
M ₂₀ element																							
Apparatus A																							
Pb element																							
N element																							
Sa element																							
Sc element																							
Sb element																							
Acodina sp. A																							
Acodina sp. B																							
Anchignathodus cristulus																							
Angulodus compressa																							
Angulodus pergracilis																							
Apatognathus sp.																							
Bispathodus aculeatus aculeatus																							
Bispathodus aculeatus plumulus	1								1	3													5
Bispathodus spinulicostatus																							
Bispathodus zieglerei																							
Clydagnathus cavusformis																							
Clydagnathus gilwernensis																		1					1
Dinodus sp.																							
Gnathodus sp.																							
Hibbardella brevialata																							
Hibbardella? helmsi																							
Hibbardella cf. H. insignis																							
Hibbardella cf. H. micra																							
Hibbardella (H.) sp. nov. Druce																							
Hindeodella acuta																							
Hindeodella brevis																							
Hindeodella corpulenta																							
Hindeodella subtilis																							
Hindeodella sp. nov. A																							
Hindeodella sp. nov. B																							
Ligonodina platys																							
Neoproniodus cf. N. alatoideus																							
Neoproniodus alatus														1									1
Neoproniodus barbatus																							
Neoproniodus sp. nov. A																							
Ozarkodina abnormis																							
Ozarkodina flexa																							
Ozarkodina cf. O. plana																							
Ozarkodina rhenana																							
Ozarkodina sp. A																							
Patrognathus sp. A																							
Polygnathus burtensis																							
Polygnathus communis collinsoni																							
Polygnathus communis communis														1									1
Polygnathus inornatus																							
Polygnathus cf. P. lacinatus										1	1	1											3
Polygnathus thomasi																							
?Polygnathus sp. A	1								2														3
Polygnathus spp.																							
Prioniodina? symmetrica																							
Pseudopolygnathus cf. Ps. dentilineatus																							
Pseudopolygnathus multistriatus																							
Pseudopolygnathus cf. Ps. nodomarginatus																							
Siphonodella cf. S. cooperi hassi																							
Siphonodella spp.																							
Spathognathodus acidentatus																							
Spathognathodus canningensis																							
Spathognathodus crassidentatus																							
Spathognathodus mehlbrai																							
Spathognathodus cf. S. robustus																							
Spathognathodus? sp. nov. A																							
Synprioniodina regularis																							
Gen. et sp. indet. A																							

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