

## Upper Devonian conodonts associated with a large placoderm fish skull from the Canning Basin, Western Australia

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### Abstract

Conodonts retrieved from limestone encasing the skull of a large placoderm fish, from an unknown location in the south-eastern Canning Basin, indicate an age of mid-Famennian (toIIB) because of the concurrent presence of the following taxa: *Nothognathella palmatifomis*, *Nothognathella* sp. nov. A. Druce 1976, *Palmatolepis glabra pectinata*, *P. quadrantinodosa inflexa*, *P. quadrantinodosa inflexoidea*, *P. marginifera* s.s., *Polygnathus triphyllatus*, *P. glaber* s.s. and *P. germanus* s.s. The assemblage represents a palmatolepid-polygnathid biofacies dominated by palmatolepids, and is typical of muddy outer shelf to sandy inner shelf environments. The occurrence of certain taxa which have only been previously recorded in the Canning Basin from the Virgin Hills Formation, together with the lithology of the specimen, and palaeoecological information afforded by the conodonts, suggests that the specimen was derived from the uppermost section of the Virgin Hills Formation.

### Introduction

A large dinichthyid placoderm fish skull has recently been described as a new genus, *Westralichthys* Long (1987) even though the exact location and lithological source of the specimen is unknown. A limited conodont fauna of 76 elements was recovered from dilute acetic acid preparation of the dinichthyid skull. The fauna contains a number of age diagnostic species which have been used to narrow the possible age and stratigraphic source of the specimen. It is significant that the conodonts indicate a much younger age for the skull than the well known lower Frasnian Gogo fish fauna (Gardiner and Miles 1975), also from the same region.

The conodont faunas from the Canning Basin have been extensively described by Glenister and Klapper (1966), Druce (1976) and Nicoll and Druce (1979), with reviews of previous work found in the latter two publications. Revisions of some of Druce's (1976) identifications by Ziegler (1977, 1981) are here included. Age ranges quoted here for taxa are from Druce (1976). For brevity I include here additional comments only where a species or subspecies name has been changed since the last record of that taxon from the Canning Basin was published; or in the event that a particularly important age-diagnostic form may be of contentious identification or differs somewhat from the previously figured examples of that species.

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Systematics

*Acodina* cf. A. "sp. nov. A." Druce 1976 p. 50

Material

3 specimens (UWA 101712 figured, Figure 1-C).

Age range

toIIa-toIV (subzones 13-22)

*Hindeodella corpulenta* Branson and Mehl, 1934

Material

1 specimen, UWA 101687 (Figure 1-B).

Age range

toIa-toIV (subzones 3-22).

*Hindeodella subtilis* Ulrich and Bassler, 1926

Material

10 specimens (UWA 101706 figured, Figure 1-E).

Age range

Throughout the section.

*Hindeodella* sp.

Material

1 specimen (UWA 101708, Figure 1-G).

Remarks

The specimen differs from the other species of *Hindeodella* previously illustrated from the Canning Basin in having a very inclined apical denticle, three moderate-sized denticles separated by two small denticles anterior to the apical denticle, and the posterior region of the bar (as preserved) has small denticles of uniform size, each about one-third as large as the apical denticle.

*Ligodina* sp.

Material

1 specimen (UWA 101728, Figure 1-D).

Remarks

The specimen most closely resembles *Ligonodina* sp. figured by Druce (1976, pl. 39-2), but differs in having a longer posterior bar with relatively smaller denticles at its posterior end.

*Neoprioniodus armatus-alatus* group

Material

1 specimen (UWA 101732, Figure 1-I).

**Remarks**

The specimen has affinities to the *N. alatus* end of the species group which Druce (1976, p. 127) found to be a continuum of morphotypes between the two species in the Canning Basin samples. It has a massive apical denticle with six small denticles, but differs from *N. alatus* in being strongly arched through a right angle, and with a longer anterior bar. The apical denticle extends over the point of arch inflexion.

**Age range**

Throughout the section (Druce 1976).

*Nothognathella palmatiformis* Druce, 1976

**Material**

2 specimens (UWA 101696, 101735; Figure 1-L, M, N).

**Age range**

Middle toIIa-toIIIB (subzones 14-10).

*Nothognathella* sp. nov. A Druce, 1976

**Material**

1 specimen (UWA 101733, Figure 1-J).

**Remarks**

The specimen closely resembles *Nothognathella* sp. nov. A figured by Druce (1976, pl. 43-5) but differs from the two illustrated examples in having a slightly longer posterior bar relative to the anterior bar, and in the apical denticle being proportionately larger than the anterior bar denticles.

**Age range**

Upper toIIIB only (subzone 17).

*Ozarkodina immersa* (Hinde, 1879)

**Material**

1 specimen (UWA 101737, Figure 1-F).

**Age range**

Throughout the section (Druce 1976).

*Ozarkodina macra* Branson and Mehl, 1934

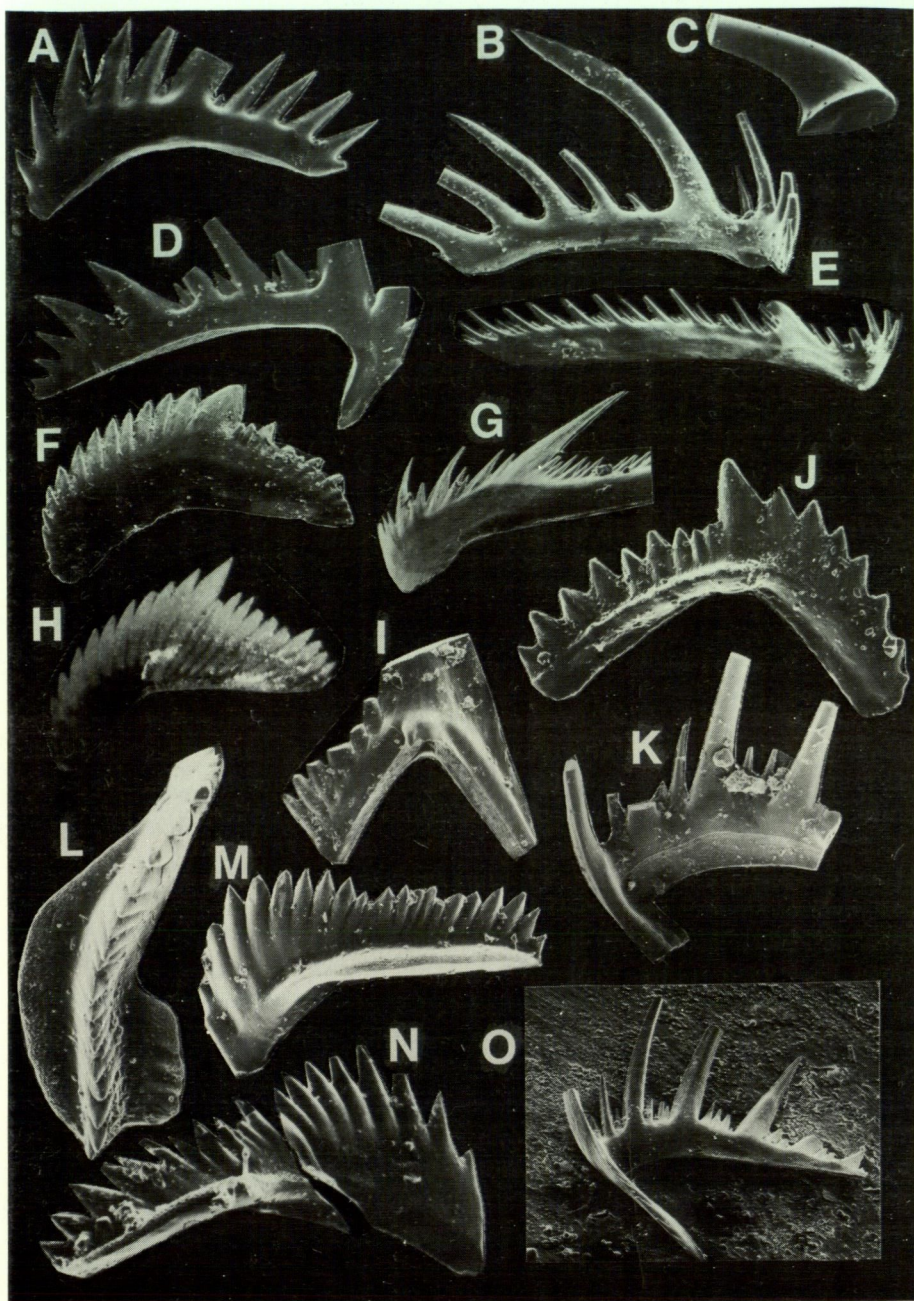
**Material**

1 specimen (UWA 101690, Figure 1-H).

**Age range**

Throughout the section (Druce 1976).

Upper Devonian conodonts



cf. *Ozarkodina? lacera* Helms, 1959

Material

1 specimen (not figured).

Age range

toIIB-toIIIB (subzones 17-20).

*Ozarkodina* sp.

Material

1 specimen (UWA 101729, Figure 1-A).

Remarks

The specimen is somewhat similar to *Ozarkodina* sp. nov. A Druce 1976 in having relatively large, free needle-like denticles. It differs in being less strongly arched, in having five anterior denticles and four posterior denticles, and in having very small denticles situated between each of the large posterior denticles and between the apical denticle and the last anterior bar denticle. *Ozarkodina* sp. nov. A Druce 1976 comes from the Middle *Polygnathus asymmetricus* zone, which would be much older than the horizon this specimen came from.

*Palmatolepis glabra pectinata* Ziegler, 1962

Material

Approx. 16 specimens (UWA 101694, 101714 figured, Figure 2-A, B, F, G).

Remarks

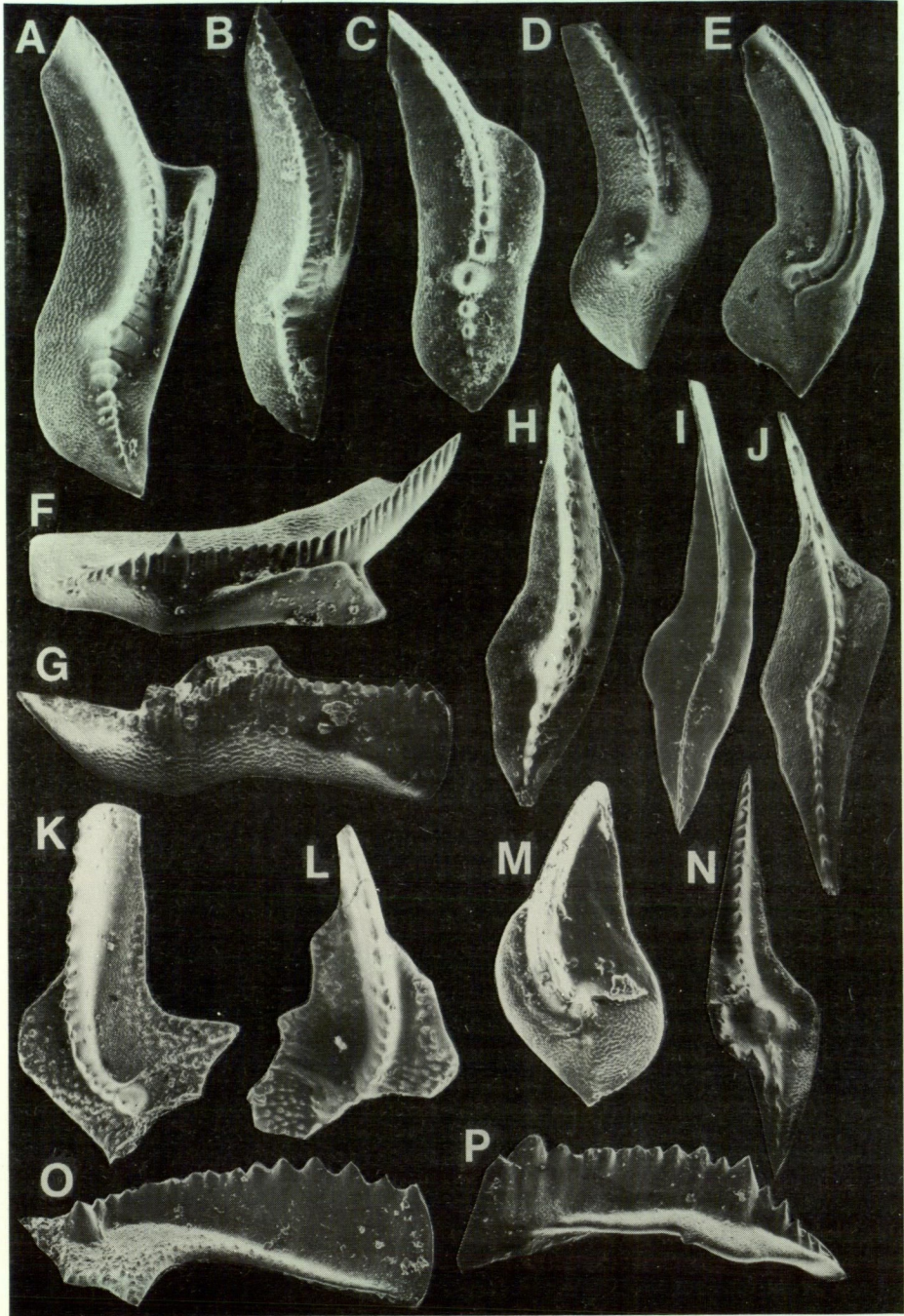
The specimens are easily recognised by comparison with those figured by Glenister and Klapper (1966), Druce (1969, 1976) and Ziegler (1977). The specimens most closely match the morphotype from the toIIB zone illustrated by Glenister and Klapper (1966, fig. 3) in which the parapet meets the blade at a right angle and is generally not denticulate, instead being composed of a smooth ridge with two or three low pinnacles.

Age range

toIIB-toIIIB (subzones 16-20).

- ◀ Figure 1 A, *Ozarkodina* sp., (UWA 101729, X47). B, *Hindeodella corpulenta* Branson and Mehl, 1934 (UWA 101687, X33). C, *Acodina* sp. nov. A, Druce 1976 (UWA 101712, X37). D, *Ligonodina* sp. (UWA 101728, X40). E, *Hindeodella subtilis* Ulrich and Bassler, 1926 (UWA 101706, X43). F, *Ozarkodina immersa* (Hinde, 1879), (UWA 101737, X45). G, *Hindeodella* sp. (UWA 101708, X80). H, *Ozarkodina macra* Branson and Mehl, 1934 (UWA 101690, X34). I, *Neoproniodus armatus-alatus* group (UWA 101732, X37). J, *Nothognathella* sp. nov. A, Druce 1976 (UWA 101733, X37). K, O, *Prioniodina? smithi* (Stauffer, 1935), (K, UWA 101698, X58; O, UWA 101731, X50). L, M, N, *Nothognathella palmatififormis* Druce, 1976 (L, M, UWA 101735, X53; N, UWA 101696, X50).

Upper Devonian conodonts



*Palmatolepis marginifera marginifera* Helms, 1959

*Palmatolepis quadrantinodosa marginifera* Druce, 1976, pl. 55, figs 1,3

*Palmatolepis marginifera marginifera* Ziegler, 1977, *Palmatolepis* plate 7, figs 17-18, pl. 8, figs 1,2

**Material**

1 specimen (UWA 101725, Figure 2-E).

**Remarks**

The specimen is recognised by its broad platform with ridge like parapet on the outer platform, being distinguished from *P. quadrantinodosa* subspecies which bear nodes running parallel to the carina (Ziegler, 1977, p. 371).

**Age range**

to IIB-to IIIa (subzones 16-19).

*Palmatolepis minuta minuta* Branson and Mehl, 1934

**Material**

Approx. 9 specimens (UWA 101691, 101695 figured, Figure 2-H, J, N, P).

**Remarks**

The specimens studied here differ from typical *P. minuta* s.s. (Ziegler, 1981) in having a longer platform size relative to the length of the free blade, and in some specimens the central node may be slightly offset from the denticle row, almost approaching the condition seen in *Pa. minuta schleizia*, yet lacking the strong lateral lobe with raised margins. Druce (1976, pl. 67, 1) figured a similar form which he referred to *Pa. minuta schleizia*, which Ziegler (1981, p. 336) has placed back in *Pa. minuta* s.s. The enormous range of variation exhibited by this common species is illustrated by Wolska (1967, fig. 13). One specimen (Figure 2-N) has an unusually long posterior carina and the outer platform margin is more lobed than other specimens, possibly representing a new subspecific variant.

**Age range**

to IIB-to IIIa (subzones 16-18).

- ◀ **Figure 2** *Palmatolepis* species. A, B, F, G, *Palmatolepis glabra pectinata* Ziegler, 1962 (A, F, UWA 101714, X 57; B, G, UWA 101694, X60). C, D, *Palmatolepis quadrantinodosa inflexoidea* Ziegler, 1962 (C, UWA 101724, X41 D, UWA 101701, X35). E, *Palmatolepis marginifera marginifera* Helms, 1959 (UWA 101725, X31). H-J, N, P, *Palmatolepis minuta minuta* Branson and Mehl, 1934 (H, P, UWA 101691, X30; I, UWA 101695, X34; J, UWA 101736, X40; N, UWA 101692, X46). K, L, O, *Palma tolepis perlobata schindewolfi* Muller, 1956 (K, O, UWA 101723, KX32, OX36; L, UWA 101722, X27). M, *Palmatolepis quadrantinodosa inflexa* Muller, 1956 (UWA 101721, X30).

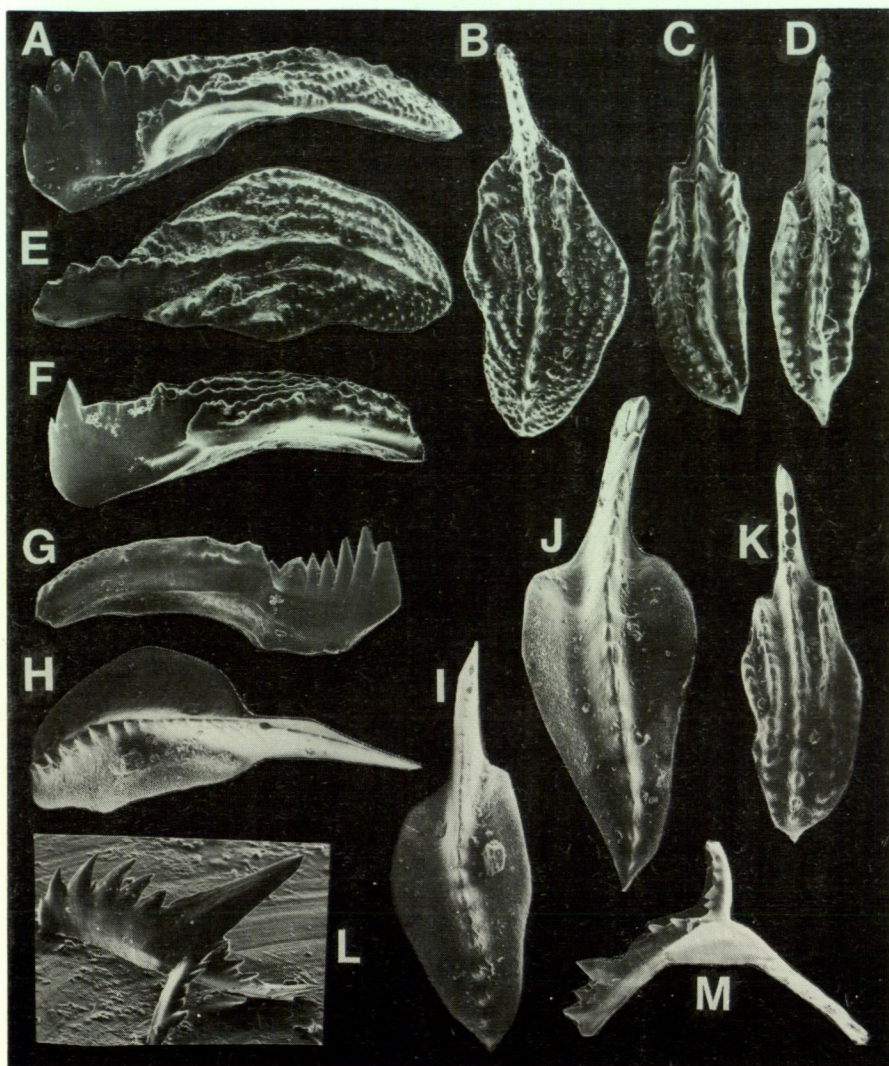


Figure 3 A, B, E, *Polygnathus triphyllatus* (Ziegler, 1960), (UWA 101700, A, E, X36, B, X33). C, D, F, G, K, *Polygnathus germanus germanus* Ulrich and Bassler, 1926 (C, G, UWA 101720, X43; D, UWA 101734, X40; F, K, UWA 101719, X42). H-J, *Polygnathus glaber glaber* Ulrich and Bassler, 1926 (H, I, UWA 101704, X 48; J, UWA 101740, X52). L, M, *Tripodellus robustus* Bischoff, 1957 (L, UWA 101726, X70; M, UWA 101727, X70).



*Palmatolepis perlobata schindewolfi*

*Palmatolepis perlobata perlobata* Glenister and Klapper, 1966, pl. 92,  
figs 8, 13; pl. 93, figs 1-6

*Palmatolepis perlobata perlobata* Druce, 1976, pl. 67, figs 5 a-c

*Palmatolepis perlobata schindewolfi* Ziegler, 1977, *Palmatolepis* plate 11,  
figs 1-7

**Material**

3 specimens (UWA 101722, 101723 figured, Figure 2-K, L, O).

**Remarks**

Although all three specimens are incomplete they are readily identified as this species by the strong inner lobe which forms almost a right angle on the outer margin, and development of a secondary crest on one specimen (as in Druce 1976, pl. 67, fig. 5b). The fine ornament indicates the subspecies variety (Ziegler 1977).

**Age range**

Middle to IIB-to V (subzones 17-23).

*Palmatolepis quadrantinodosa inflexa* Muller, 1956b

*Palmatolepis quadrantinodosa* cf. *marginifera* Glenister and Klapper, 1966,  
pl. 91, figs 16-18

*Palmatolepis quadrantinodosa inflexa* Ziegler, 1977, *Palmatolepis*  
pl. 12, figs 3-10

**Material**

1 specimen (UWA 101721, Figure 2-M).

**Remarks**

Druce (1976) did not find this subspecies in his study of the Canning Basin conodonts, yet Glenister and Klapper (1966) recorded two specimens both from the Virgin Hills Formation. All three known specimens from the Canning Basin are of the short oval morphotype illustrated by Ziegler (1977, Pa. plate 12, fig. 10).

**Age range.**

Worldwide: upper rhomboidea zone (subzone 16) — lower marginifera zone (subzone 17).

*Palmatolepis quadrantinodosa inflexoidea* Ziegler, 1962

**Material**

3 specimens (UWA 101701, 101724 figured, Figure 2-C, D).

**Age range**

to IIB (subzones 16, 17).

*Polygnathus glaber glaber* Ulrich and Bassler, 1926

**Material**

9 specimens (UWA 101703, 101704 figured, Figure 3 H-J).

**Age range**

to IIA-upper to IIB (subzones 14-17).

*Polygnathus germanus germanus* Ulrich and Bassler, 1926

**Material**

3 specimens, all figured (UWA 101719, 101920, 101734, Figure 3-C, D, F, G, K).

**Age range**

toIIa-toIIa (subzones 13-18).

*Polygnathus triphyllatus* (Ziegler, 1960)

**Material**

1 specimen (UWA 101700, Figure 3-A, B, E).

**Remarks**

The species is recognised by comparison with one specimen illustrated by Druce (1976, pl. 81-6) which has a broader platform with three or more rows of nodes as compared to the narrower platform types illustrated (e.g. Wolska, 1967, pl. 17-4; Druce (1976, pl. 81, 4-5). UWA 101700 is distinguished from *P. pennatuloides*, of which one specimen is known from the Canning Basin (Glenister and Klapper, 1966, pl. 94-12, 13) by having a narrower basal cavity, the carina is not as strongly incurved, the platform is more elaborately ornamented, and meets the free blade at a deeper groove on the inner side, and also by the broader anterior end of the outer platform (from observation of UWA 35885).

**Age range**

toIIB (subzones 16-17). If this identification is incorrect the only other alternative is to assign the specimen to *P. pennatuloides* Holmes, 1928, which also has a very narrow age range (lower to IIIa), although this would mean a slightly older occurrence if the age of this fauna, as deduced at the end of this paper (subzone 17), is correct.

*Prioniodina? smithi* (Stauffer, 1935)

**Material**

3 specimens (UWA 101698, 101731 figured, Figure 1-K, O).

**Age range**

toId-toVI (subzones 14-21).

*Scutula* cf. *S. bipennata* Sanneman, 1955

**Material**

1 specimen (not figured, UWA 101707).

**Age range**

toIIB-toIIIB (subzones 16-20).

*Tripodellus robustus* Bischoff, 1957

**Material**

2 specimens (UWA 101726, 101727, Figure 3-L, M).

**Age range**

toIIIB-lower toIV (subzones 16-21).

## Age and lithological source of the dinichthyid specimen

The dinichthyid specimen is determined as being of maximum age lower to IIB (rhomboidea zone) by the first entry in the Canning Basin conodont faunas of the following taxa: *Palmatolepis glabra pectinata*, *Pa. marginifera marginifera*, *Pa. quadrantinodosa inflexa*, *Pa. quadrantinodosa inflexoidea*, *Polygnathus triphyllatus* and *Tripodellus robustus*. The minimum age of the specimen is uppermost

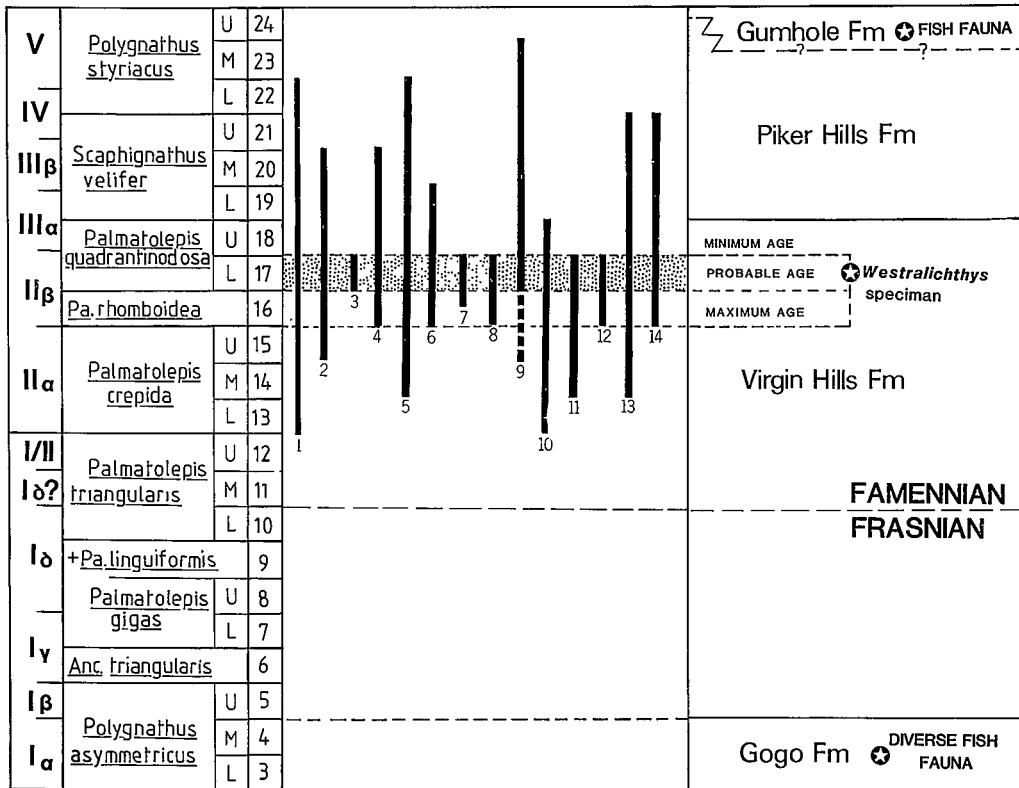


Figure 4 Age ranges of certain short-ranging conodont taxa found associated with the dinichthyid skull. Ages, ranges and subzones based on Druce (1976) for the Canning Basin only, except for *Palmatolepis quadrantinodosa inflexa* (7) which comes from Ziegler (1977) based on European occurrences. The Canning Basin formations representing basin facies are shown on the right with known fish faunas indicated by a star. 1, *Acodina* sp. nov. A, Druce 1976. 2, *Nothognathella palmatiformis* Druce, 1976. 3, *Nothognathella* sp. nov. A, Druce, 1976. 4, *Palmatolepis glabra pectinata* Ziegler, 1962. 5, *Pa. minuta minuta* Branson and Mehl 1934. 6, *Pa. marginifera marginifera* Helms, 1959. 7, *Pa. quadrantinodosa inflexa* Muller, 1956. 8, *Pa. quad. inflexoidea* Ziegler, 1962. 9, *Pa. perlobata schindewolfi* Muller, 1956. 10, *Polygnathus germanus germanus* Ulrich and Bassler, 1926. 11, *Pol. glaber glaber* Ulrich and Bassler, 1926. 12, *Pol. triphyllatus* (Ziegler, 1960). 13, *Prioniodina? smithi* (Stauffer, 1935). 14, *Tripodellus robustus* Bischoff, 1957.

toIIB (top of subzone 17) as indicated by the last appearance of the following taxa: *Nothognathella* sp. nov. A Druce 1976, *Palmatolepis quadrantinodosa inflexa*, *Pa. quadrantinodosa inflexoidea*, *Polygnathus glaber glaber* and *Pol. triphyllatus*. Further refinement of this range (from subzones 16-17 to only subzone 17; Figure 4) is indicated by the presence of *Nothognathella* sp. nov. A Druce 1976 which has only been recorded from the lower quadrantinodosa zone. The assemblage is typical of the lower marginifera zone of Ziegler and Sandberg (1984) in containing *Pa. marginifera* s.s. in association with *Pa. quadrantinodosa inflexa* and *Pa. quadrantinodosa inflexoidea*.

This conodont assemblage is typical of the palmatolepid-polygnathid biofacies (facies II, Sandberg and Dreesen 1984), although palmatolepids are distinctly dominant indicating a lean towards the deep water association (palmatolepid facies I, Sandberg and Dreesen 1984). The absence of *Icriodus* and *Peleksygnathus* in the sample corroborates this view. The depositional environment most favoured by this assemblage would be muddy outer shelf to sandier inner shelf.

The Virgin Hills Formation is the most likely source of the specimen, as suggested by Gilbert-Tomlinson (1968, p. 210), for three reasons. Firstly it agrees best with the lithology encasing the specimen in being a fine-grained carbonate with low fossil content, and in having tinges of orange colouring and deep red haematitic deposits on the bone surface (Playford and Lowry 1967). Secondly the conodont biofacies association and age determined from conodonts indicate that the source of the specimen was from basinal facies of mid Famennian (toIIB) age. Only the Virgin Hills Formation meets these two criteria. Finally several of the conodonts in the fauna have previously been found only from the Virgin Hills Formation (*Palmatolepis quadrantinodosa inflexoidea*; *Pa. perlobata* s.s., *Polygnathus triphyllatus*, *Pol. glaber glaber*, *Pol. germanus* s.s.). This indicates that they were either restricted in the Canning Basin to this facies, or that all of these forms recorded here represent new occurrences of these taxa from another formation. In conclusion it is most probable that the dinichthyid came from the lower *Palmatolepis quadrantinodosa* zone (subzone 17 of Druce 1976) in the upper section of the Virgin Hills Formation, south-eastern Canning Basin.

#### Acknowledgements

Sincere thanks to Dr R. Nicoll (Bureau of Mineral Resources, Canberra) and Dr Ken McNamara (Western Australian Museum) for comments on the manuscript; to Ms Gina Rockett (Geology Museum, University of WA) for permission to borrow the Canning Basin conodont collection of Glenister for comparative study; and to Dr Philip Playford (Geological Survey of Western Australia) for helpful discussion of the lithological source of the specimen. This research was funded through a National Research Fellowship — Queen Elizabeth II Award.

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