Lower Triassic (Smithian) conodonts from northwest Pahang Peninsular Malaysia

I. METCALFE
Department of Geology & Geophysics, University of New England, Armidale, NSW 2351, Australia

ABSTRACT
Lower Triassic conodonts are reported from limestones, interpreted as a possible submarine slump, exposed along the new Kuala Lipis - Gua Musang highway, northwest Pahang, Peninsular Malaysia. The co-occurrence of *Neospathodus triangularis* (Bender), *Platyvillosus costatus* (Staesch), *Neospathodus dieneri* Sweet and *Platyvillosus hamadai* Koike in the fauna indicates a Scythian (late Smithian) age. *Platyvillosus hamadai* is unknown from the Peri-Gondwana province and its occurrence in the fauna supports a pre-Early Triassic rifting of the Malay Peninsula from Gondwana. *J. Micropalaeont.* **11** (1): 13-19, June 1992.

INTRODUCTION
The Triassic sedimentary rocks of Peninsular Malaysia are distributed in three sedimentary regions that are characterised by distinctive sedimentary facies (Fig. 1). In the western part of the Peninsula, on the Sibumasu terrane, two regions are recognised, an early to late Triassic carbonate platform in the northwest (Chuping and Kodiang Limestones), which extends into Thailand and Sumatra, and a deep-water basinal sequence (Semangol Formation) to the southeast that comprises Lower to Upper Triassic cherts and Upper Triassic turbiditic rhythmites and conglomerates and which also extends into central Sumatra (Metcalfe 1989a, 1990a). Both of these Triassic sequences are essentially devoid of volcanic components (Metcalfe 1990a). East of the Bentong-Raub suture, on the East Malaya block and in the "Central Belt" or Central Basin of the Peninsula (Fig. 1), a thick sequence of Lower to Upper Triassic limestones and slope-deposted volcaniclastics occur (Metcalfe et al., 1982; Khoo, 1983; Metcalfe, 1989b). The Lower Triassic in the Central Basin was until recently poorly known, the bulk of Triassic exposures in the basin being Middle - Upper Triassic Semantan Formation and equivalents. Limestones and shales of the Early Triassic Gua Musang Formation are exposed near the centre of the basin and contain conodonts, ammonoids and bivalves (Igo et al., 1965; Hada, 1966; Ichikawa and Yin, 1966; Tamura, 1968).

The recent discovery of Lower Triassic olistostromes and limestones and Middle Triassic limestones in the Raub area on the western margin of the Central Basin (Metcalfe, 1989a, 1989b, 1990b) suggests that the Early Triassic is largely represented by limestones and/or olistostromes and that limestones persisted into the Middle Triassic on the western basin margin. This is unlike the Middle Triassic rocks of other parts of the basin which are mainly slope-deposited volcaniclastics.

Lower Triassic conodonts are poorly known in the Malay Peninsula. Griesbachian conodonts are unknown apart from a single specimen of *Isarcicella isarcica* (Huckriede) reworked into Spathian sediments near Raub (Metcalfe, 1991). Dienerian conodonts were only recently identified in the Peninsula where a fauna representative of the latest Dienerian was discovered in the Jerus Limestone near Cheroh, Pahang (Metcalfe, 1990a). Smithian conodonts are known from the Gua Musang Formation, Kelantan (Igo et al., 1965), from the Kodiang Limestone of Bukit Hantu, Kedah (Metcalfe, 1981) and from Gunong Keriang, Kedah (Koike 1982).

CONODONT FAUNAS AND AGE
The fauna reported in this paper was extracted from limestones exposed in a road cutting (locality A) on the new Kuala Lipis - Gua Musang road immediately south west of where the road crosses Sungei Jeleteh (Fig.2). The limestone is massive and pale grey in colour and occurrs as several discrete bodies and large clasts which are overlain and enveloped by shales and siltstones of unknown age (Fig. 3). Similar Lower Triassic deposits, interpreted as olistostromes, occur in the Raub area (Chakraborty and Metcalfe, 1987; Metcalfe, 1989b) and this suggests that the locality A sediments may also represent a similar large slump or olistostrome deposit (Fig.3).

Four conodont samples were collected from four different limestone bodies and blocks at this locality (Fig.3) and a rich conodont fauna was obtained from these (table 1, plates 1 and 2). The fauna includes *Neospathodus dieneri* Sweet, *Neospathodus triangularis* (Bender), *Platyvillosus costatus* (Staesch) and *Platyvillosus hamadai* Koike (plate 1). All these species are known only from the Lower Triassic (Scythian). *Neospathodus dieneri* ranges from the Griesbachian to the late Smithian but is most common in the Dienerian and Smithian (Ziegler, 1973; Collinson & Hasenmueller, 1978; Koike, 1981; Sweet, 1988a, 1988b). *Neospathodus triangularis* ranges from the late Smithian to the basal Anisian (Sweet et al., 1971; Solien, 1979; Budurov et al., 1987; Koike, 1981; Sweet, 1988a, 1988b). *Platyvillosus costatus* was until recently regarded as characteristic of the basal Spathian in North America (Sweet et al., 1971; Solien, 1979; Clark et al., 1979) but Sweet (1988a, 1988b) using graphical correlation methods, has shown that this species is confined to the Smithian. The species has been reported from the basal Spathian in Europe (Bender, 1967)

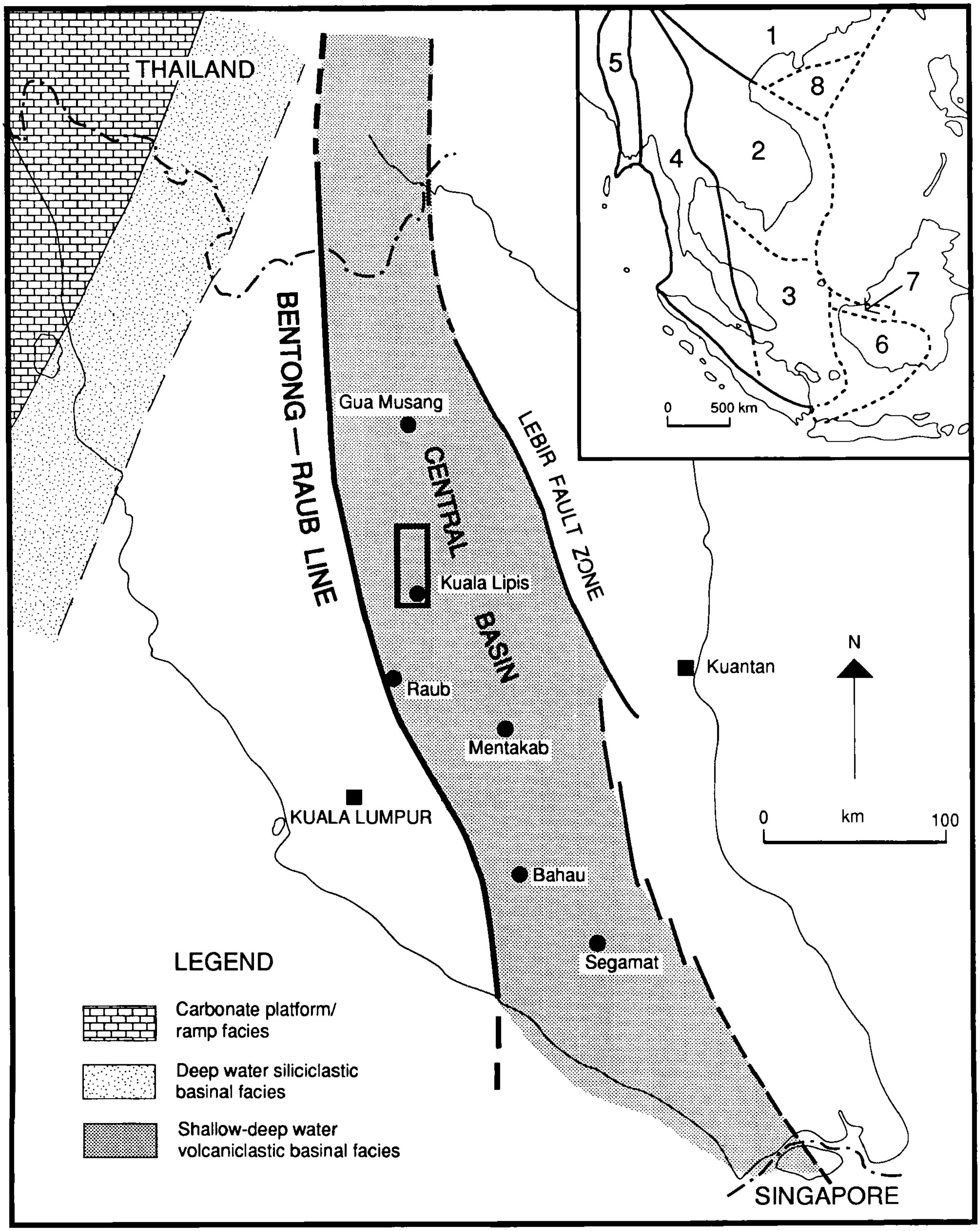

Fig.1. Map showing the distribution of the three Triassic sedimentary regions in Peninsular Malaysia, the location of the study area and place names mentioned in the text. Inset map shows the principal tectonic blocks of the region. 1, South China; 2, Indochina; 3, East Malaya; 4, Sibumasu; 5, Mount Victoria Land; 6, S.W. Borneo; 7, Semitau; 8, Hainanese terranes.

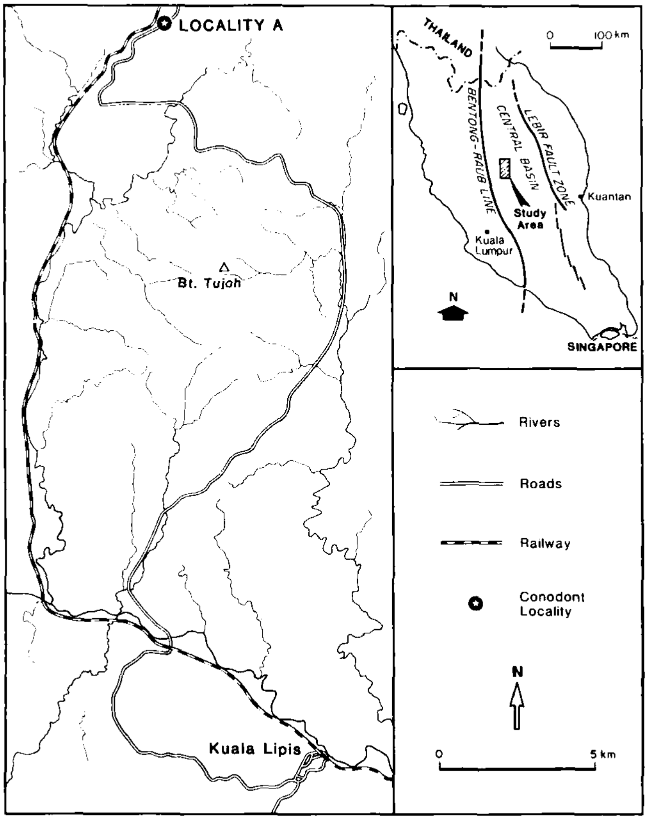

Fig. 2. Sketch map showing the location of the conodont locality A. For general location see figure 1.

SPECIES	1013	1014	1015	1016
Cypridodella magnidentata (Tatge), Sb.			1	
Cypridodella muelleri (Tatge), Sb.			1	1
Cypridodella sp., Sa.		1		
Cypridodella sp., Sb.	1	1	1	
Cypridodella sp., Sc.	1			
Cypridodella sp., Pb.		1		1
Ellisonia bogschi (Kozur & Mostler), Pa.		1		
Ellisonia nevadensis (Muller), Pa.		2	1	1
Ellisonia triassica (Muller), M.			1	1
Ellisonia sp., M.				1
Furnishius sp., Sb?				1
Neospathodus dieneri Sweet, Pa.		23	10	53
Neospathodus triangularis (Bender), Pa.	1	4	23	1
Neospathodus sp., Pa.		6	1	2
Platyvillosus costatus (Staesch), Pa.	2			
Platyvillosus hamadai Koike, Pa.	1			
Xaniognathus saginatus (Huckriede), Pa.	1	1	2	
Xaniognathus sp., Pa.		2		
Unidentifiable elements	5	9	4	14
TOTAL	11	50	45	78

Table 1. Conodont elements recorded from locality A (All samples were 2kg in weight)

and Russia (Buyri, 1979) but it has also been reported from the Dienerian of the Himalayas (Goel, 1977) and China (Tian et al., 1983) and from the Smithian of Kedah, Peninsular Malaysia (Koike, 1982) and Japan (Koike, 1988). This species therefore ranges from Dienerian to early Spathian. *Platyvillosus hamadai* was first described from the Smithian in Kedah, Malaysia (Koike, 1982) and has since been reported from the Smithian of Japan (Koike, 1988). Specimens described as *Platyvillosus laevigatus* by Tian et al. (1983) were considered to belong to *Platyvillosus hamadai* by Koike (1988) and occur in Dienerian strata. *Platyvillosus hamadai* therefore ranges from Dienerian to Smithian. From the above discussion, the co-occurrence of *N. triangularis, N. dieneri, P. costatus,* and *P. hamadai* would indicate a late Smithian age for the limestones at locality A.

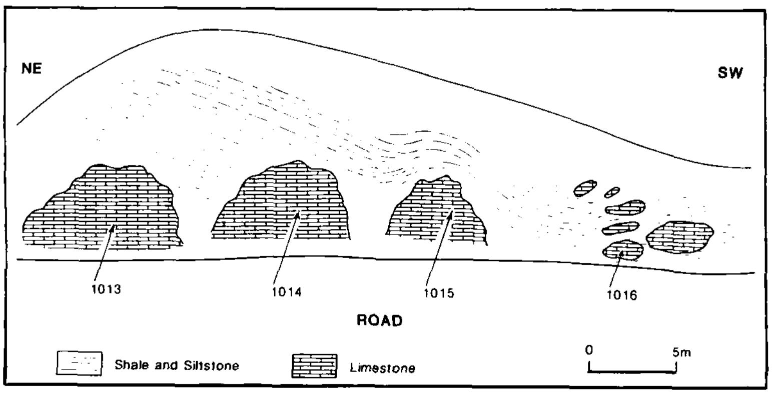

Fig. 3. Sketch of road cutting at loc. A showing the Spathian limestone exposures.

All the conodont elements recovered exhibit a colour alteration index (CAI) of 5 indicating that they have been heated to between 300 and 480 degrees centigrade (Epstein et al., 1977). They do not however show any gross distortions as seen in regionally metamorphosed rocks (Rejebian et al., 1987) and are in general well preserved apart from some surface pitting (plates 1 and 2). This suggests that they have been subject to thermal heating due to burial or proximity to a heat source. It is unlikely that there has ever been sufficient sedimentary cover to produce a CAI of 5 by burial (even with high geothermal gradients) and this is probably the result of contact thermal heating by the nearby Early Jurassic (204 Ma) Bukit Tujoh granite (Fig 2).

SYSTEMATIC NOTES

Neospathodus dieneri Sweet, 1970
(Pl. 1, figs 1-5)

For synonomy and description see Sweet (1970), Ziegler (1973) & Matsuda (1982)

Remarks. The specimens reported in this paper conform well to descriptions given by Sweet (1970) and Matsuda (1982).

Neospathodus triangularis (Bender, 1967)
(Pl. 1, figs 6, 7)

For synonomy and description see Bender (1967), Ziegler (1973), Matsuda (1983) and Perri (1985)

Remarks. This species is characterised by having a short, high blade and a triangular or heart-shaped basal cavity. The species differs from the similar N. homeri (Bender) by the broader basal cavity and shorter blade of N. triangularis.

Platyvillosus costatus (Staesche, 1964)
(Pl. 1, fig. 8)

For synonomy and description see Staesche (1964), Goel (1977) and Koike (1988)

Remarks. The specimens reported here represent the morphotype (Form M) of Koike (1988) with only weakly developed ridges on the lateral margins of the upper surface.

Platyvillosus hamadai Koike, 1982
(Pl. 1, fig. 9)

For synonymy and description see Koike (1982, 1988)

Remarks. This species is distinguishable from *P. costatus* and *P. asperatus* Clark, Sincavage and Stone by its lack of nodes or ridges on the upper surface of the platform.

DISCUSSION

Olistostromes of Upper Permian or Lower Triassic age and Lower Triassic limestone conglomerates have been identified in the Raub area (Chakraborty & Metcalfe, 1987; Metcalfe, 1989b). The limestone conglomerates were interpreted as possible fault scarp tallus by Metcalfe (1989b) and the limestone bodies and blocks exposed in the road cutting here described may also be a large slump deposit associated with a steep palaeoslope (fault scarp?). The presence of extensive olistostromes and slump deposits along the western margin of the central basin of the Malay Peninsula suggests active tectonics during the early Triassic. The tectonic setting of the Central Basin of the Malay Peninsula is still contentious with various models ranging from an aborted rift (Tan, 1976, 1984) to back-arc basin (Hutchison, 1973) to fore-arc basin (Sengor 1986). The wide ranging tectonic models reflect the paucity of stratigraphical, palaeontological, sedimentological and geochemical data for the basin. Recent work in Thailand suggests that the Triassic basins of north Thailand (mainly half grabens) probably opened as a result of post orogenic collapse following the late Permian - early Triassic orogeny (Cooper et al., 1989). There was clearly active tectonics taking place in the Malay Peninsula during the Early Triassic which produced olistostromes and limestone conglomerates regarded as fault tallus. The Lower Triassic olistostromes in the Raub-Bentong area have been interpreted as part of the Bentong-Raub Suture by Tjia (1989) and related to eastwards subduction of the palaeotethys beneath East Malaya.

Much recent debate has centred on the timing of the suturing of Sibumasu to Indochina/East Malaya along the Uttaradit-Nan and Bentong-Raub sutures with various suturing ages proposed including Late Triassic, Late Permian and Early Triassic. Some authors (Audley-Charles, 1988; Audley-Charles et al., 1988) have considered that the Malay Peninsula remained part of eastern Gondwana until the Middle Jurassic.

The fauna reported in this paper contains the species *Platyvillosus hamadai* which is restricted to the early Triassic northern hemisphere "Tethys Province" and which does not occur in the contemporaneous southern hemisphere "Peri-Gondwana Province" (Matsuda, 1985). This suggests that the Malay Peninsula probably rifted from Gondwana in the Permian and was in low northern palaeolatitudes by the early Triassic as indicated by the palaeomagnetic data (Metcalfe, 1990c).

The texturally well preserved conodonts from locality A (plates 1 and 2) suggest that they have not been involved in regional metamorphism which would imply that any collisional orogeny that occurred during the suturing of Sibumasu to East Malaya must have been pre-Smithian in age.

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Explanation of Plate 1.

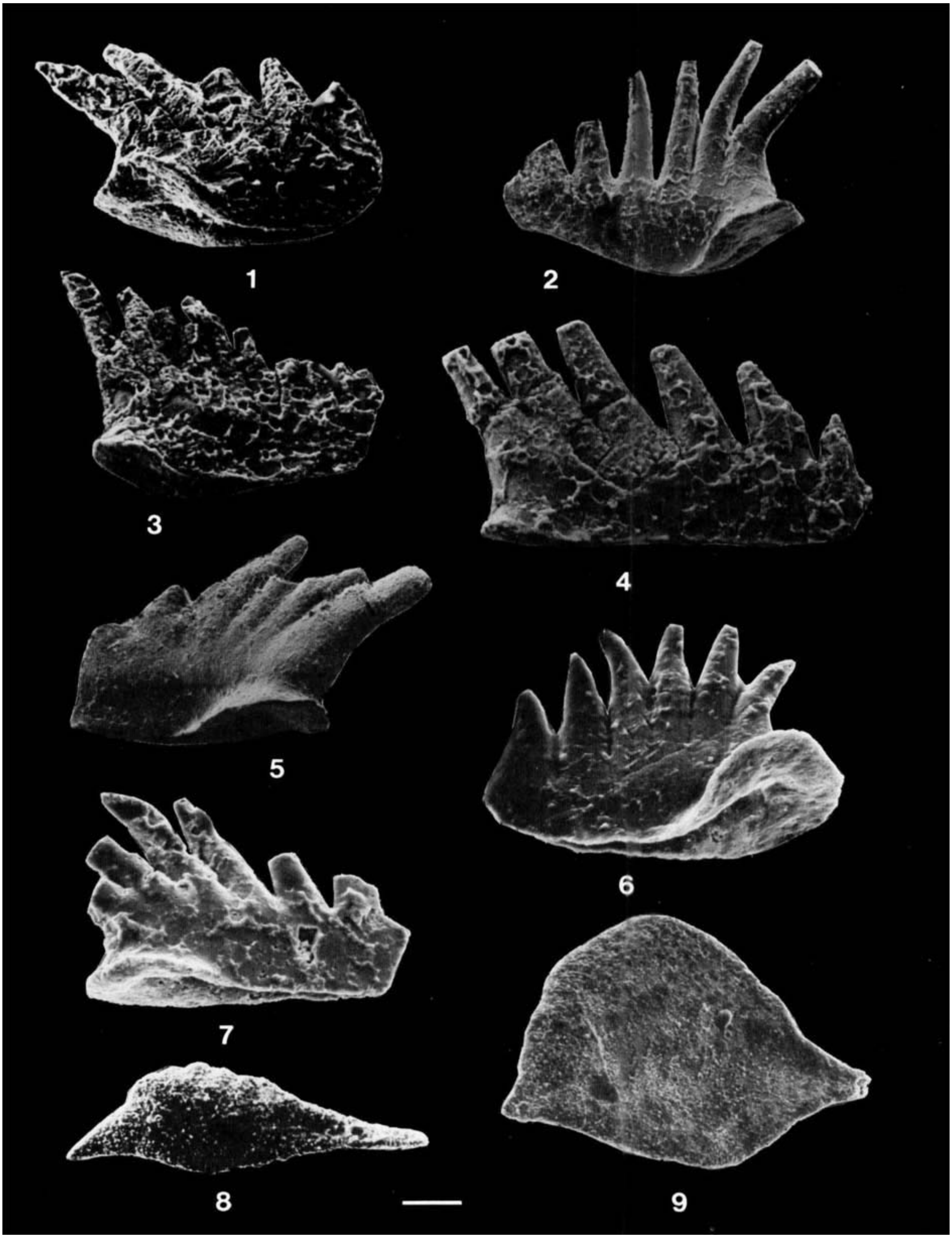
Smithian conodonts from Pahang, Peninsular Malaysia. All figured specimens are deposited at the Department of Geology & Geophysics, University of New England. The first four digits of specimen numbers are sample numbers. Scale bar represents 100 microns.

Figs. 1-5. *Neospathodus dieneri* Sweet, Pa elements. All lateral view. **Fig. 1**, specimen 1014/1; **Fig. 2**, specimen 1015/1; **Fig. 3**, specimen 1016/1; **Fig. 4**, specimen 1016/2; **Fig. 5**, specimen 1015/2.

Figs. 6,7. *Neospathodus triangularis* (Bender), Pa elements. Lateral views. **Fig. 6**, specimen 1015/3; **Fig. 7**, Lateral view, specimen 1016/3.

Fig. 8. *Platyvillosus costatus* (Staesch), Pa element, oral view, specimen 1013/1.

Fig. 9. *Platyvillosus hamadai* Koike, oral view, specimen 1013/2.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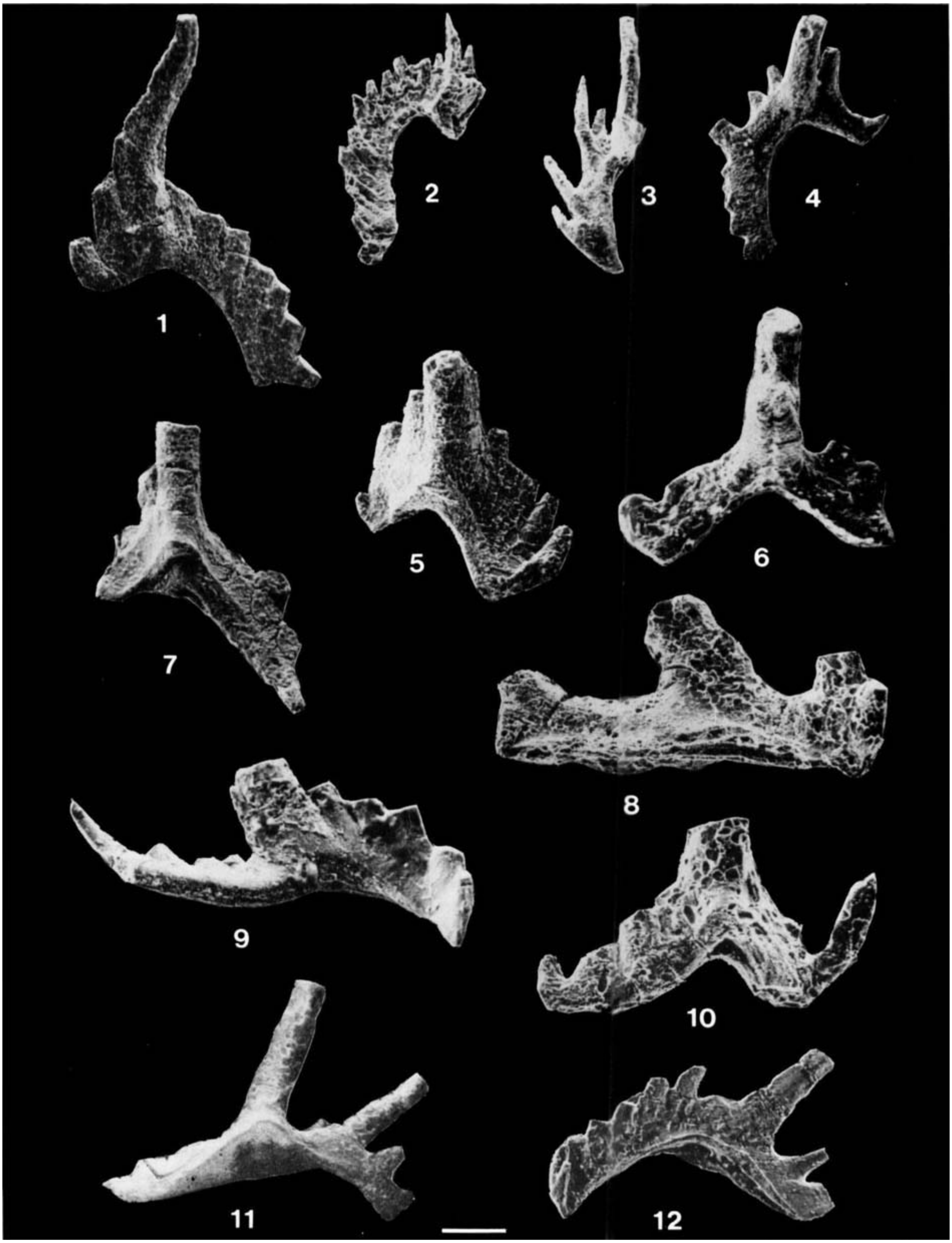
Explanation of Plate 2

Smithian conodonts from Pahang, Peninsular Malaysia.
Fig.1. *Cypridodella magnidentata* (Tatge), Sb element, lateral view, specimen 1015/4.
Fig.2. *Cypridodella muelleri* (Tatge), Sb element, lateral view, specimen 1016/4.
Figs.3-6. *Cypridodella* sp.Posterior views. **Fig.3**. Pb element,specimen 1016/5. **Fig. 4.** Sc element, specimen 1013/3. **Fig. 5.** Sb element, specimen 1013/4. **Fig. 6.** Sa element, specimen 1014/2.
Fig.7. *Ellisonia triassica* (Muller), M element, posterior view, specimen 1015/5.
Fig.8. *Ellisonia nevadensis* (Muller), Pa element, lateral view, specimen 1016/6.
Fig.9. *Ellisonia bogschi* (Kozur & Mostler), Pa element, lateral view, specimen 1015/6.
Fig.10. *Ellisonia* sp., M element, posterior view, specimen 1016/7.
Fig.11. *Furnishius* sp., Sb? element, lateral view, specimen 1016/8.
Fig.12. *Xaniognathus saginatus* (Huckriede), Pa element, lateral view, specimen 1015/7.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