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Permian and Early Triassic conodonts from Northwest Peninsular Malaysia

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Abstract: Limestones exposed at Gunong Keriang, Kedah, have yielded conodonts representative of the Early Permian (Wolfcampian) *Neogondolella bisselli-Sweetognathus whitei* and the Early Triassic (Smithian) *Neospathodus waageni* Zones.

The Kodiang Limestone exposed at Bukit Hantu near Kodiang, Kedah has yielded conodonts representative of the Late Permian (Capitanian) *Neogondolella rosenkrantzi–Neospathodus divergens* Zone and species of *Neospathodus* characteristic of the Early Triassic. The Permian-Triassic boundary is for the first time recognised in exposed sections in Malaysia. Since the Kodiang Limestone is shown to extend down into the Permian it is considered probable that it is continuous with the underlying Chuping Limestone.

The Middle and Late Permian appear to be absent at Gunong Keriang, being cut out by an unconformity or non-sequence.

INTRODUCTION

Early Triassic conodonts have previously been reported from three localities in Peninsular Malaysia. Igo, Koike and Yin (1965) reported Triassic conodonts from Gua Panjang, south of Gua Musang, Kelantan. Their fauna was dominated by bar conodonts and was interpreted to be Anisian in age. However, in the light of more recent studies of Triassic conodont biostratigraphy, the presence of *Neospathodus conservativus* (Müller) in the fauna shows it to be of Smithian age (Igo and Koike, 1975). Two other localities yielding Early Triassic conodonts were also reported by Igo and Koike (1975). A fauna containing *Neospathodus bicuspidatus* (Müller), which is restricted to the early Triassic (Ziegler, 1973), was reported from dark grey limestones at Merapoh, Pahang and referred by Igo and Koike (1975) to the Smithian. Another Smithian fauna was also reported from limestones with interbedded thin black shales from "the basal part of the section" exposed at Gunong Keriang, Kedah. This fauna contained *Neospathodus conservativus* (Müller) which is restricted to the Smithian.

Permian conodonts have only recently been described from Malaysia (Metcalfe, 1981). Limestones at Gunong Kanthan, Perak have yielded *Anchignathodus minutus* (Ellison) and *Neogondolella bisselli* (Clark and Behnken) which indicate an early Permian (Wolfcampian) age. Only two other reports of Permian conodonts from South East Asia have been made and both of these are from north Thailand. Igo (1974) described an early Permian fauna from limestones yielding *Pseudoschwagerina* Zone foraminifera. However, the conodonts recovered are forms which range from late Carboniferous to early Permian elsewhere. Stoppel (*in* Baum *et al.*, 1970) reported a fauna with *Neogondolella idahoensis* (Youngquist, Hawley and Miller) and *Neogondolella rosenkrantzi* (Bender and Stoppel) and referred this fauna to the upper Middle Permian. However, this fauna is more likely to be Late Permian (Capitanian) in age since it contains *N. rosenkrantzi* which is characteristic of the Capitanian (Behnken, 1975).

Limestone exposed as hills around Kodiang and at Gunong Keriang north of Alor Star, Kedah, were until recently regarded as representing the Permian Chuping Limestone (Alexander, 1965; Burton, 1965) but the discovering of Triassic conodonts in these limestones (Ishii and Nogami, 1966; Nogami, 1968) and detailed petrographic and stratigraphic studies (DeCoo and Smit, 1975) led to the establishment of a new limestone formation, the Kodiang Limestone, for the limestones of the Kodiang area. The limestone of Gunong Keriang, however, was considered lithologically different by DeCoo and Smit (1975) and they did not include this under their Kodiang Limestone. The age of the Chuping Limestone is not well known except that a good Middle Permian shelly fauna occurs near its base (Jones *et al.*, 1966). Gobbett (1973, p. 70) considered it possible that the Chuping and Kodiang limestones form a continuous sequence. Detailed biostratigraphical work is required in order to elucidate the relationship between these limestones.

In this paper, preliminary results of conodont biostratigraphical work on these limestones is presented which have implications regarding the relationship between the Chuping and Kodiang Limestones and on the Permian-Triassic boundary in north-west Malaya. Conodonts are reported from two localities, the limestones of Gunong Keriang (Loc. 1) and the Kodiang Limestone of Bukit Hantu (Loc. 2). See figure 1 for locality details.

Conodont faunas and age

Locality 1: Gunong Keriang

Fifteen samples were collected from the limestone section exposed in the Hip Huat Quarry on the western side of Gunong Keriang. The total thickness of strata exposed is 182 metres. See figure 2 for a lithological section and for sample horizons. Conodonts were recovered from nine of fifteen samples and full details of the faunas will be published separately. Most of the conodont elements recovered are of the bar type and are not precise age indicators. However, several samples did contain diagnostic platform conodonts. Sample 810 contains elements of *Sweetognathus whitei* (Rhodes) which is diagnostic of the late Wolfcampian *Neogondolella bisselli-Sweetognathus whitei* Zone of North America. Sample 811, taken 8 metres above 810, however, contains *Neospathodus waageni* Sweet which is diagnostic of the Early Triassic (Smithian) *N. waageni* Zone. Igo and Koike (1975) recorded *Neospathodus conservativus* (Müller) "from the basal part of the section" at Gunong Keriang. However, the exact location of their sample was not given but was probably from the bedded limestones overlying the Permian dolomite. The presence of *N. conservativus* indicated a Smithian age which is consistent with the findings of the present work. There is a large difference in age between sample 810 (Early Permian, Wolfcampian) and 811 (Early Triassic, Smithian) with only 8 metres of strata separating them. A marked change in lithology also occurs between these samples from dolomite to bedded limestones with an irregular, possibly erosive contact 5 metres above sample 810 (see fig. 2). The Middle and Late Permian are either extremely thin in this section or, more likely, are cut out by a non-sequence or unconformity occurring at the

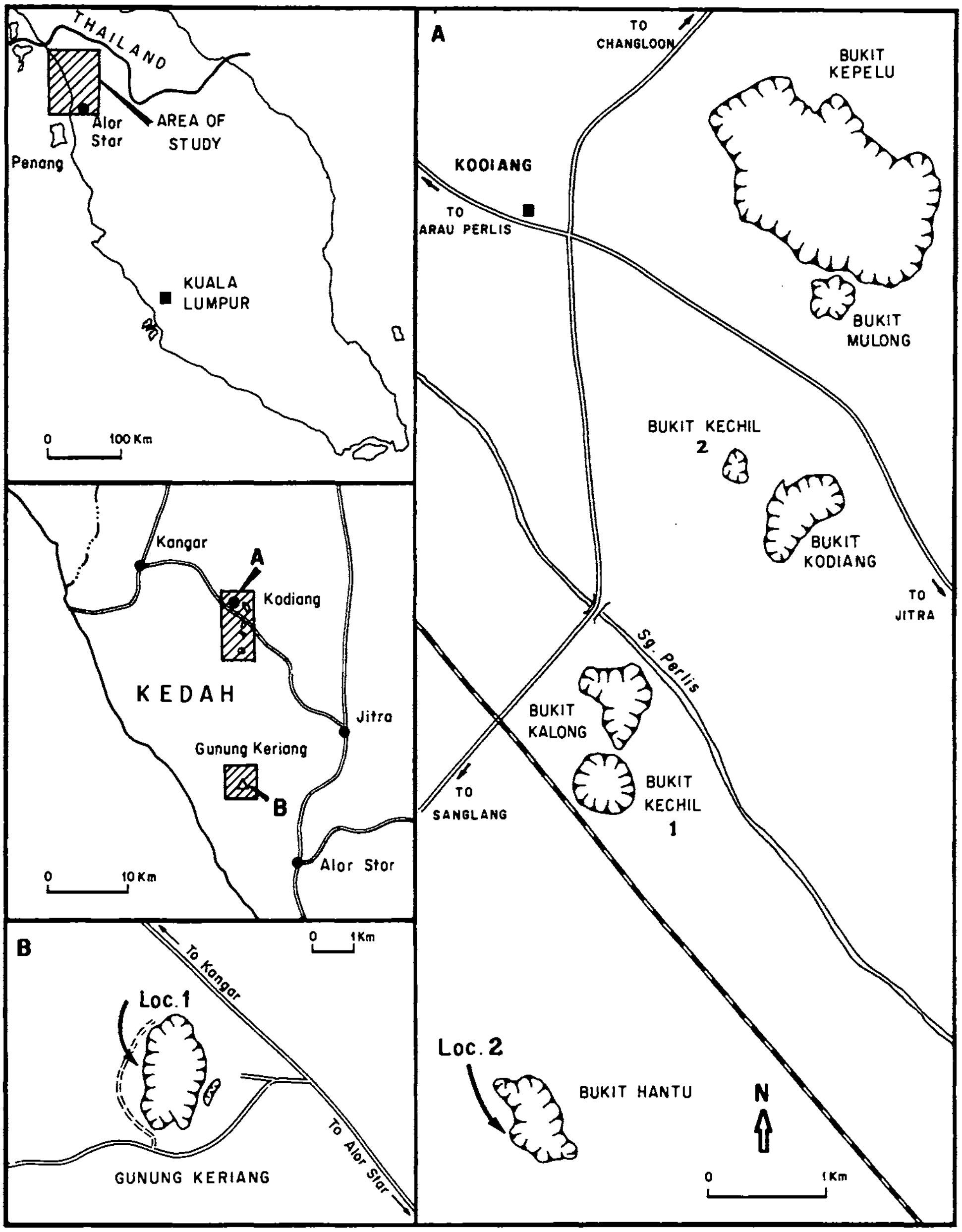

Fig. 1. Sketch map showing the locations of Gunong Keriang (locality 1) and Bukit Hantu (locality 2).

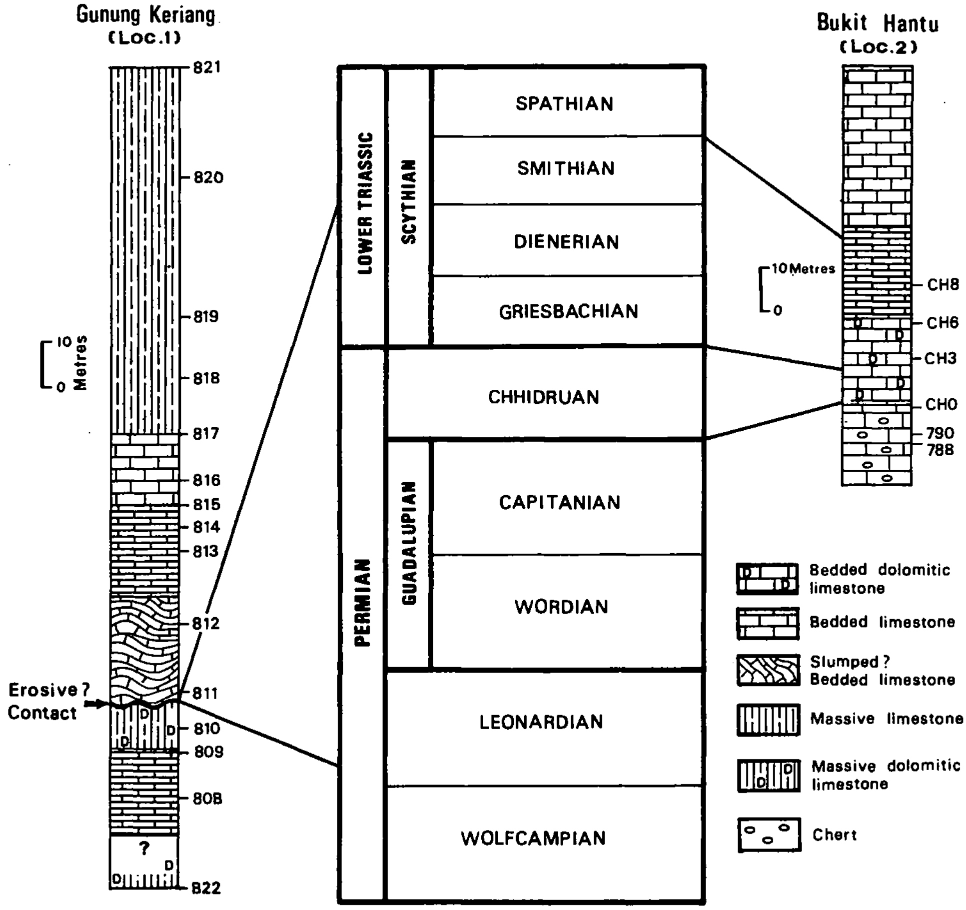

Fig. 2 Lithological sections exposed at Gunong Keriang and Bukit Hantu showing conodont sample horizons.

junction between the dolomite and the bedded limestones. Samples from the upper part of the section at Gunong Keriang were found barren of conodonts so the upward age extension of these limestones is unknown but thought likely to be Early Triassic. The recognition of the Permian-Triassic boundary in a completely exposed section and the presence of a probable unconformity at that boundary is an important discovery which has interesting implications (see below).

Locality 2: Bukit Hantu

Six samples (see fig. 2) have so far yielded age indicative conodonts. Samples 788, 790 and CHO all yield *Neogondolella rosenkrantzi* (Bender and Stoppel) which is characteristic of the late Permian *N. rosenkrantzi* assemblage zone (Capitanian). Sample 790 also contains *Neogondolella orientalis* (Barskov and Koroleva) which has only been recorded from the Late Permian. The abundance of *N. rosenkrantzi* suggests a Capitanian age for these three samples but this species is also known from the Chhidruan and a slightly younger Permian age is also possible. Sample CH3 yielded *Neospathodus bicuspidatus* (Müller), a typical Early Triassic form (Ziegler, 1973). Sample CH6 yielded *Neospathodus waageni* Sweet which is dignostic of the Smithian and sample CH8 yielded *Neospathodus dieneri* Sweet which has a range from Dienerian to Smithian. It appears probable that samples CH3, CH6 and CH8 are all of Smithian age. The Permian-Triassic boundary must therefore be located between samples CH0 and CH3 in the lower part of the section exposed at Bukit Hantu.

DISCUSSION

The recognition of Permian conodonts at Bukit Hantu shows that the Kodiang Limestone of DeCoo and Smit (1975) extends down into the Permian. There does not appear to be a break in the sequence at the Permian-Triassic boundary in the Kodiang Limestone at Bukit Hantu. However, at Gunong Keriang 16 kilometres to the south there is a major break with the Middle and Late Permian absent. Recent work in north Sumatra (Cameron *et al.*, 1980) shows a major orogeny during Middle Permian times. Evidence of a similar event in Malaya was not previously known. The section at Gunong Keriang appears to show Lower Triassic Kodiang Limestone resting unconformably on Chuping Limestone. Further to the north in the type area of the Kodiang Limestone, the base of this formation is older (late Permian). It is not known if an unconformity is present at the base of the Kodiang Limestone around Kodiang. Further detailed work on the microfossil faunas from these limestones is under progress which should reveal any stratigraphic breaks in the sequence.

CONCLUSIONS

1. The Kodiang Limestone is shown to extend down into the late Permian and apparently spans the Permian-Triassic boundary without a break.

2. The limestones of Gunong Keriang range in age from Early Permian to Early Triassic.

3. There is an unconformity or non-sequence in Gunong Keriang cutting out the Middle and Late Permian.

4. The upper part of the Gunong Keriang section appears to represent the Kodiang Limestone which is resting unconformably on Chuping Limestone.

5. The large time-gap represented by the stratigraphic break at Gunong Keriang corresponds closely in age to the Permian orogeny which took place in Sumatra.

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PLATE EXPLANATION

Figs. 1–5. *Sweetognathus whitei* (Rhodes)

1. Oral view of A566, sample 810, × 74
2. Lateral view of A566, × 74
3. Oral view of A567, sample 810, × 74
4. Aboral view of A568, sample 810, × 74
5. Oral view of A569, sample 810, × 74

Figs. 6, 7. *Neospathodus waageni* Sweet

6. Lateral view of A570, sample 811, × 37
7. Lateral view of A571, sample 811, × 74

Figs. 8–12, 14–16. *Neogondolella rosenkrantzi* (Bender and Stoppel)

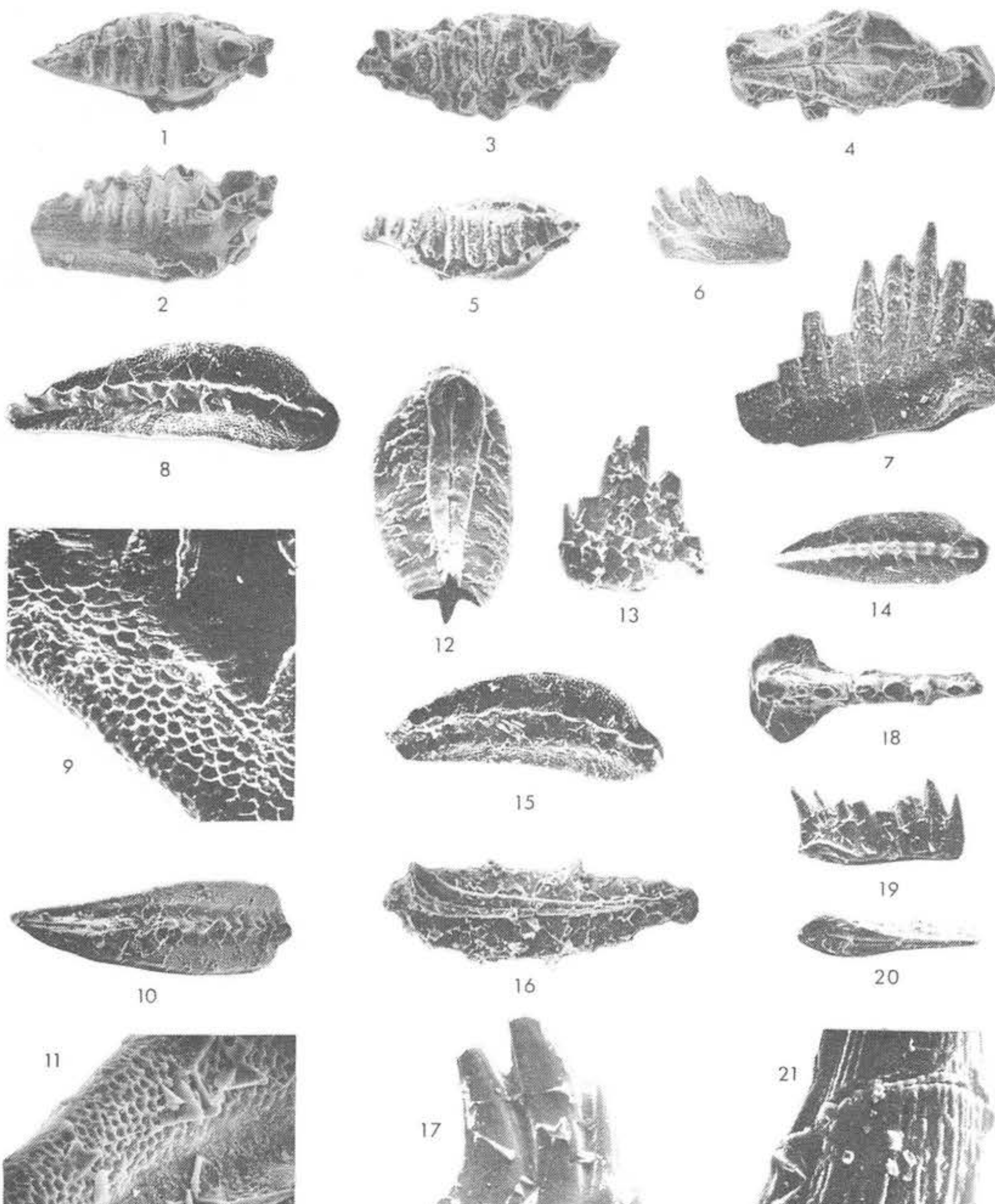
8. Oral view of A572, sample CHO, × 74
9. Detail of platform margin of A572, × 370
10. Oral view of A573, sample 788, × 37
11. Detail of platform of A573, × 370
12. Aboral view of A574, sample CHO, × 74
14. Oral view of A575, sample CHO, × 37
15. Oral view of A576, sample CHO, × 74
16. Aboral view of A577, sample 788, × 74

Figs. 13, 17. *Neospathodus dieneri* Sweet

13. Lateral view of A578, sample CH8, × 74
17. Lateral view of A579, sample CH8, × 185

Figs. 18–21. *Neospathodus bicuspidatus* (Müller)

18. Oral view of A580, sample CH3, × 74
19. Lateral view of A581, sample CH3, × 37
20. Aboral view of A581, × 37
21. Detail of denticle of A581, × 740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REFERENCES

ALEXANDER, J.B., 1965. Geological map of Malaya, sixth edition, 1: 500,000. *Geol. Surv. Dep. West Malaysia.*

BEHNKEN, F.H., 1975. Leonardian and Guadalupian (Permian) conodont biostratigraphy in western and southwestern United States. *J. Paleont., 49,* 284–315.

BURTON, C.K., 1965. Wrench faulting in Malaya. *J. Geol., 73,* 783–98.

CAMERON, N.R., CLARKE, M.C.G., ALDISS, D.T., ASPEN, J.A. and DJUNUDDIN, A., 1980. *The geological evolution of northern Sumatra.* Paper presented at the Ninth Indonesian Petroleum Association Convention, 1980. 55 pp.

DECOO, J.C.M. and SMIT, O.E., 1975. The Triassic Kodiang Limestone Formation in Kedah, West Malaysia. *Geologie en Mijbn., 54,* 169–176.

GOBBETT, D.J., 1973. Upper Paleozoic. *In:* Gobett, D.J. and Hutchison, C.S. (Eds.). *Geology of the Malay Peninsula,* Wiley, New York, 61–95.

IGO, H., 1974. Lower Permian conodonts from northern Thailand. *Geol. Palaeont Southeast Asia, 14,* 1–6.

IGO, H. and KOIKE, T., 1975. Triassic conodonts from West Malaysia. *In:* Triassic System of Malaysia, Thailand and some adjacent areas, Tamura *et al., Geol. Palaeont. Southeast Asia, 15,* 135–142.

IGO, H., KOIKE, T. and YIN, E.H., 1965. Triassic conodonts from Kelantan, Malaya (studies of Asiatic conodonts, part III). *Mem. Mejiro Gakuen Women's Junior Coll., 2,* 5–20.

ISHII, K. and NOGAMI, Y., 1966. Discovery of Triassic conodonts from the so-called Paleozoic Limestone in Kedah, Malaya. *J. Geosci. Osaka City Univ. 9,* 93–98.

JONES, C.R., GOBBETT, D.J. and KOBAYASHI, T., 1966. Summary of fossil record in Malaya and Singapore, 1800–1965. *Geol. Palaeont. Southeast Asia, 2,* 309–359.

METCALFE, I., 1981. A late Wolfcampian (Early Permian) conodont fauna from Perak, Peninsular Malaysia. *Warta Geologi, 7,* 76–79.

NOGAMI, Y., 1968. Trias-Conodonten von Timor, Malaysian und Japan (Palaeontological study of Portuguese Timor, 5) *Mem. Fac. Sci. Kyoto Univ.,* 34, 115–136.

STOPPEL, D., Appendix *In*: BAUM, F., BRAUN, E., HAHN, L., HESS, A, KOCH, K.E., KRUE, G., QUARCH, H. and SIEBENHÜNER, M., 1970. On the geology of northern Thailand, *Beih. geol. Jb.* 102, 1–23.

ZIEGLER, W. (ed.) 1973. *Catalogue of conodonts.* Schwiezerbart'sche Verlags-buchhandlung, 1, 504. Stuttgart.

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