

The discovery of Late Permian (early Changshingian) brachiopods from Penjom, Pahang Darul Makmur

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Abstract: A brachiopod fauna has been recently discovered in dark grey calcareous shale at Penjom, near Kuala Lipis, Pahang. The fauna consists of *Peltichia kwangtungensis* (Zhan), ?*Peltichia* sp., *Semibrachythyryna rhombiformis* Shen & He, *Semibrachythyryna* sp., ?*Spiriferellina* sp., ?*Anchorhynchia* sp., ?*Acosarina* sp., *Derbyia* sp. and unidentified meekellid, rhynchonellid and productid. The brachiopod faunal assemblage suggests a Late Permian (early Changshingian) age to the calcareous shale bed and the associated limestone in the block below the Penjom thrust. The brachiopod genus *Peltichia* Jin & Liao is reported for the first time in Malaysia.

Abstrak: Fauna brakiopod telah ditemui dalam lapisan syal berkapur kelabu gelap di Penjom, berhampiran Kuala Lipis, Pahang. Fauna ini mengandungi *Peltichia kwangtungensis* (Zhan), ?*Peltichia* sp., *Semibrachythyryna rhombiformis* Shen & He, *Semibrachythyryna* sp., ?*Spiriferellina* sp., ?*Anchorhynchia* sp., ?*Acosarina* sp., *Derbyia* sp. dan spesies meekellid, rhynchonellid dan productid yang tidak boleh dikenalpasti. Himpunan fauna brakiopod mencadangkan usia Perm Akhir (awal Changshingian) bagi syal berkapur dan batu kapur pada blok bawah sesar sungkup Penjom. Brakiopod genus *Peltichia* Jin & Liao dilaporkan buat pertama kalinya di Malaysia.

INTRODUCTION

The geology and stratigraphy of the area west of Kuala Lipis Town has not been fully understood partly because of insufficient detailed research and partly due to the lack of fossils in most of the studied sections. Procter (1980) had introduced a stratigraphic unit called the Raub Group comprising the Sungai Kenong, Sungai Sergis and Padang Tengku formations for the area around Padang Tengku. Correlation between these formations was entirely based on lithostratigraphy, which was interpreted as progressively younging to the east. The Sungai Kenong Formation in the west is the oldest formation, overlain successively by the Sungai Sergis and the Padang Tengku Formations. According to Procter (1981), the Raub Group is a Carboniferous-Permian lithologic unit. This was based on earlier findings of (?)Carboniferous fossils from the Gua Sei and Penjom Mill Gully by Scrivenor (1911) and Permian fossils from Sungai Kelidik, all of which apparently came from the younger formation of his Raub Group.

Mohd Shafeea Leman (1987) disputed the usage of the stratigraphic term Raub Group by Procter (1980) since a similar terminology has already been deployed by Jaafar Ahmad (1976) to describe Triassic Semantan and Kaling Formations in the Raub area. Alternatively, he used the term Gua Musang formation as the lithologic sequence in the Padang Tengku area, as it seems closely comparable to the Permo-Triassic sequence in Gua Musang and Merapoh areas, informally named by Yin (1965) as the Gua Musang

formation. This was further supported by the discoveries of Permian fossils from Kg. Gua, Kg. Garok and Terenggun (Mohd Shafeea Leman, 1993, 1995) and Gua Bama (Lim & Nuraiting Tee Abdullah, 1994). The Gua Musang formation has been described by Yin (1965) in an unpublished report, but has subsequently been adopted by Burton (1973). The latter pointed out that the Gua Musang formation could be extended southward to as far as the Kuala Lipis area. This would probably include the Permian of Padang Tengku and the studied Penjom areas. Later authors such as Kidd & Fauzi Zainuddin (2000) and Sony *et al.* (2001), however, preferred to use Padang Tengku Formation instead of Gua Musang formation.

In recent years, open-pit gold mining activities have been reactivated in the Penjom area (Figure 1), east of Tasik Jaleh and south of Tasik Terenggun in the district of Kuala Lipis. These activities exposed excellent fresh outcrops in several mine pits, permitting geologists great opportunity to study them and add to the available geological records. In 2003, the UKM authors were given permission to study some of these outcrops by Specific Resources Bhd. Penjom Gold Mine. The aim of the study was to determine the age and stratigraphic significance of the limestone and other calcareous horizons exposed in the north-northwest part of the Kelampong East Pit. A brachiopod-bearing horizon was discovered during this research. This paper will highlight some of the research findings especially those in relation to the age and stratigraphy of the brachiopod-bearing horizon.

GEOLOGY OF THE STUDY LOCALITY

Kelampong East Pit (Figure 2) is currently the most active pit operated by the Penjom Gold Mine. The geology of the Kelampong East Pit has been studied by various authors with different fields of interest. In general, there are two main rock types in this pit, viz. sedimentary and igneous intrusive rocks. The sedimentary host rocks consist mainly of shale, mudstone, siltstone and sandstone with subordinate conglomerate and limestone. Heru Sigit Purwanto *et al.* (2000), Wan Fuad Wan Hassan and Heru Sigit Purwanto (2001) and Sony *et al.* (2001) also mentioned the domination of tuffs and other pyroclastic rocks in the host rock sequence. The sedimentary rock sequence has a general E-W strike, dipping gently to the south.

The sedimentary and pyroclastic host rocks are intruded by numerous sills of felsic igneous rock identified as felsite by Sony *et al.* (2001), microgranite and rhyodacite by Heru Sigit Purwanto *et al.* (2000) and Wan Fuad Wan Hassan & Heru Sigit Purwanto (2001) and referred to as tonalite in this paper. Both the sedimentary and igneous rocks have been displaced by various kinds of fault including among others the Penjom Thrust fault, which apparently divide the sedimentary sequence into two main blocks (Figure 2). The thrust overhanging block in the southeastern sector of the pit is mainly made up of thinly interbedded shale with lesser sandstone, while the underlying block consists mainly of thick calcareous shale and mudstone, with subordinate sandstone, conglomerate and limestone.

The limestone occurrence at Kelampong East Pit has been reported by Heru Sigit Purwanto *et al.* (2000), Wan Fuad Wan Hassan & Heru Sigit Purwanto (2001) and Sony *et al.* (2001), but not much of it was discussed. Sony *et al.* (2001) only mentioned that some of the fine-grained

sedimentary rocks are also calcareous and grade into limestone. This study is focused on the sedimentary rock sequence containing small limestone blocks (Figure 3) exposed in the north of the mine pit. The studied section belonged to the blocks below the Penjom thrust. Three lithologic logs were measured along three separate terraces shown in Figure 2, from which a composite log (Figure 3) was constructed.

STUDY SECTION

The studied section is generally dominated by a sequence of moderate to thickly bedded dark grey calcareous shale and mudstone (Figure 3), dipping 40°-50° to the WSW. In the lower part of the sequence the calcareous shale/mudstone layers are interbedded with sandstone, pebbly sandstone and conglomerate with rounded to sub-angular clasts mainly of volcanic origin (Figure 3). The coarser clastic sediments decrease gradually towards the top of the studied section to give it a general fining upward sequence. In the middle part of the sequence, calcareous shale and mudstone are dominant, in places containing rare micro- and macrofossils. In the upper part of the sequence calcareous shale and mudstone beds are thicker. A lens of dark grey limestone (Figure 3) is developed at this interval. It is made up mainly of micritic limestone, but in places biomicritic limestone prevails with bioclastic allochems of algae, foraminifera and bryozoan fragments. The limestone gradually changes to calcareous shale both laterally and vertically. The calcareous shale is also dark grey in colour, occasionally stained by oxidized pyrites.

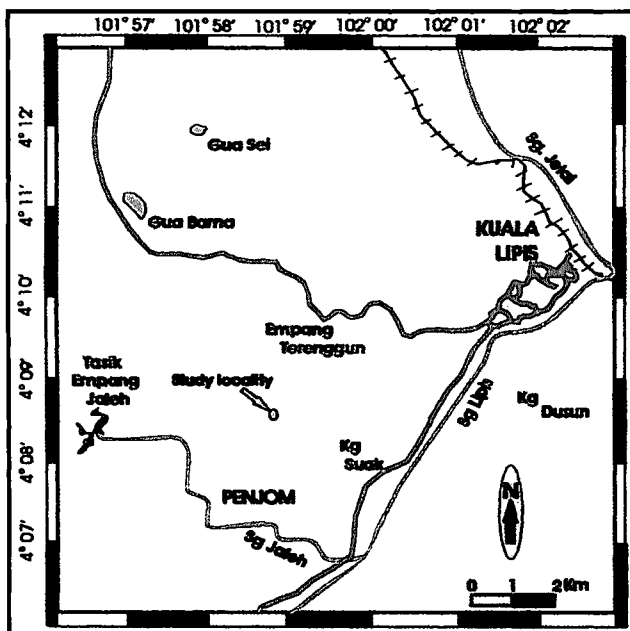


Figure 1. Location of the study locality.

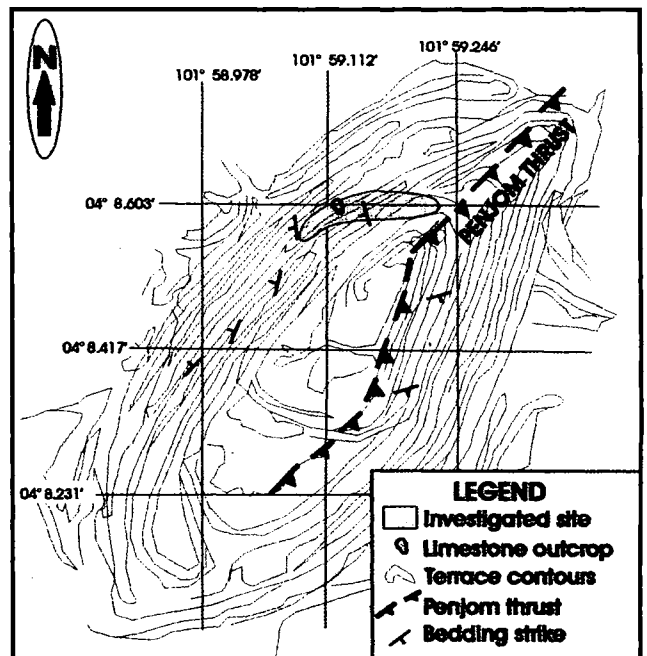


Figure 2. Kelampong East Pit showing the location of limestone lens and the study section. (Courtesy of Specific Resources Sdn Bhd Penjom Gold Mine).

BRACHIOPOD FAUNA

The brachiopod fauna was found mainly in the dark grey calcareous shale immediately overlying the limestone-bearing horizon, with minor occurrence in the underlying limestone lens. They are randomly distributed within the thick shale bed. Most of the brachiopods are preserved as external or internal moulds, exhibiting excellent exterior and interior morphologies. At least nine brachiopod genera were identified from the Penjom locality. The Penjom brachiopod fauna consists of *Peltichia kwangtungensis* (Zhan), *?Peltichia* sp., *Semibrachythyryna rhombiformis* Shen & He, *Semibrachythyryna* sp., *?Spiriferellina* sp., *?Anchorhynchia* sp., *?Acosarina* sp., *Derbyia* sp. and unidentified meekellid, rhynchonellid and productid. Some of these brachiopods are presented in Figure 4. The limestone lens also yields some microfossils including fusulinid *Palaeofusulina* sp. and small foraminifera *Reichellina* sp., algae and bryozoan skeletons. Identification of foraminiferas could not be done precisely due to damage on the wall structure of the tests probably due to hydrothermal alteration.

AGE AND STRATIGRAPHY

Among the most significant brachiopod species found at Penjom are *Peltichia kwangtungensis* (Zhan) and *Semibrachythyryna rhombiformis* Shen & He. The genus *Peltichia* Jin & Liao, according to Shen *et al.* (1999) is an important Late Permian brachiopod genus in the Tethys Ocean. Though the genus ranges in age from late Early Permian (Kungurian) to Late Permian, most of the species are Late Permian in age. The Malaysian species strongly resembles *Peltichia kwangtungensis* (Zhan) described by Shi & Shen (1998) from the Yenduyet Formation of Son La in northwest Vietnam in having a large transversely sub-elliptical outline with strongly built pseudocruralium on its dorsal valve (Figure 4). It is very important to note that this species has only been recorded in early Changhsingian stage (Shen *et al.*, 1999). Up till now, it has only been recorded from the early Changhsingian Wangpanli Formation of Guangdong, Chenninghsien Formation of Guizhou, Raggyorcaka Formation of northern Xizang and Huai Tak Formation in northwest Thailand.

The discovery of *Peltichia kwangtungensis* (Zhan) in Penjom calcareous shale suggests that the study horizon is of Late Permian (most probably early Changhsingian) age. The species was found together with another Changhsingian species *Semibrachythyryna rhombiformis* Shen & He. The latter was described by Shen & He (1994) from the Changhsing Formation in Guiding, Guizhou. It differs from other *Semibrachythyryna* in having a rhomboidal outline and more pointed beak (Figure 4). Other species include *Semibrachythyryna* sp., *?Peltichia* sp., *?Spiriferellina* sp., *?Anchorhynchia* sp., *Derbyia* sp. and *?Acosarina* sp.

Middle and Late Permian brachiopod faunas have been recorded in several localities within the Gua Musang

formation in south Kelantan and northwest Pahang (Figure 5). The occurrence of Late Permian brachiopod fauna was first reported by Muir-Wood (1948) from Sungai Jemuru in Kuala Lipis area. Later, Jones *et al.* (1966) and Mohd Shafeea Leman (1993, 1994) mentioned a widespread distribution of late Permian brachiopod fauna in the Merapoh area associated with *Leptodus* bearing shale. Part of these faunas have been redescribed by Campi *et al.* (2000, 2002) as a late Middle Permian fauna, thus establishing an older age limit of the brachiopod horizon in this formation. Meanwhile, in the Padang Tengku area (immediately north of the present locality) several Late Permian brachiopod horizons were reported by Mohd Shafeea Leman (1993, 1995). The present brachiopod fauna adds to the list of Late Permian brachiopod fauna and

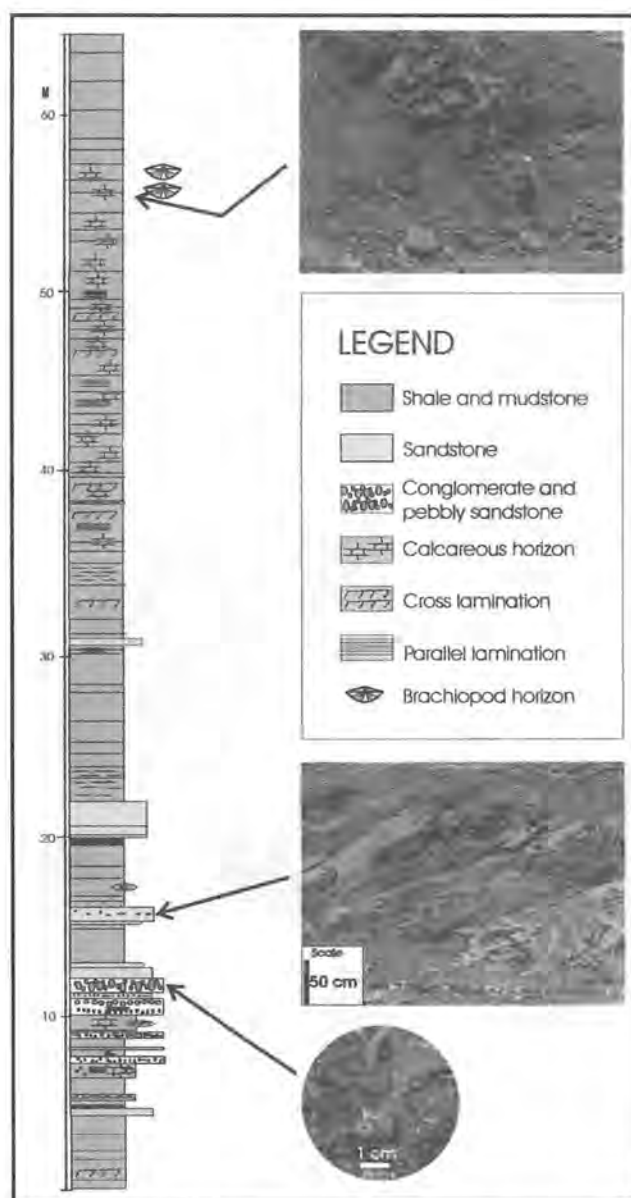


Figure 3. Lithologic log along the study section showing the position of the brachiopod horizon. Inserts are figures of limestone lens (top), sandstone interbedded with shale (middle) and conglomerate with predominantly volcanic clasts (bottom).

supports that the brachiopod-bearing shale of the Gua Musang formation ranges in age from Middle to Late Permian. More details on the age and spatial distribution of brachiopod horizons in the Gua Musang formation is tabulated in Figure 5.

Note on palaeobiogeography of *Peltichia*. According to Shen *et al.* (1999) *Peltichia* has only been recorded in the Permian of Tethys, mostly in East Asia. The Penjom species marks the first occurrence of the genus in Malaysia and represents the southernmost palaeogeographic distribution of the genus in the Permian of Tethys Ocean. The southernmost occurrences of *Peltichia* were previously recorded by Waterhouse (1983) in Huai Tak Formation of northwest Thailand and by Shi & Shen (1998) from the Yenduyet Formation of Son La in northwest Vietnam.

CONCLUSION

The brachiopod-bearing calcareous shale and limestone found in the north-northwest part of the Kelampong East Pit in the Penjom Gold Mine is Late Permian (most probably early Changhsingian) in age. This horizon represents the

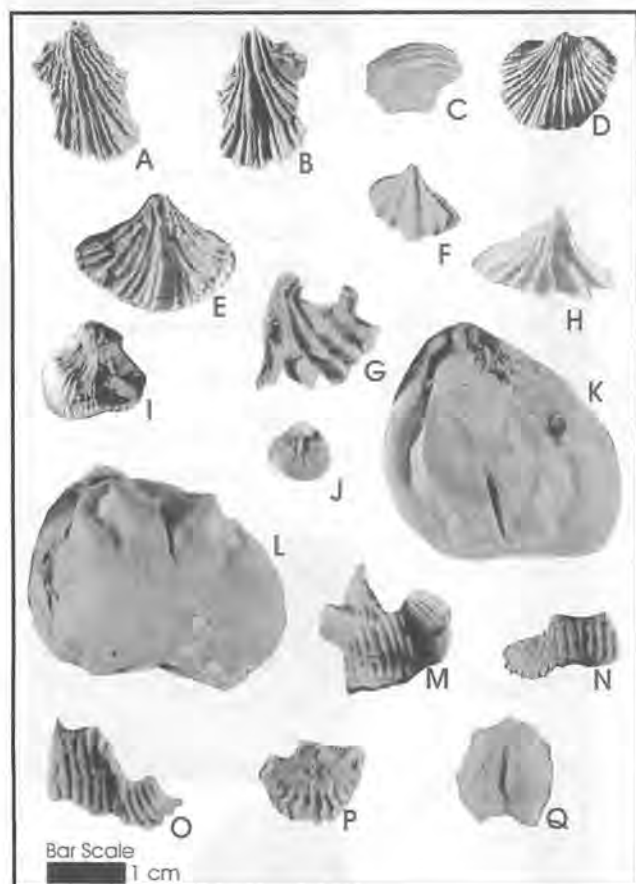


Figure 4. Representative of Penjom brachiopods. A-B, D – *Semibrachythyryna* sp. (A,D – dorsal valves, B – ventral valve); C, E – *Semibrachythyryna rhombiformis* Shen & He (dorsal valves); F-H – *Spiriferellina* sp., I – *Derbyia* sp., J – *Peltichia* sp. (dorsal view), K-L – *Peltichia kwangtungensis* (Zhan) (dorsal valve; K – anterior view; L – dorsal view), M-O – *Anchorhynchia* sp., P – meekellid gen et sp indet., Q – *Acosarina* sp.

southern extension of the Permo-Triassic Gua Musang formation, which yields numerous brachiopod horizons of Middle to Late Permian age. The Penjom brachiopod fauna correlates very well with some other Late Permian brachiopod faunas of the Tethyan Ocean.

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Period	Epoch	Stage	Middle - Late Permian brachiopod horizons in Gua Musang Formation
TRIASSIC	EARLY	Dienerian	
		Greibachian	
PERMIAN	LATE (LOPINGIAN)	Changhsingian	A B D E F
		Wuchiapingian	C
	MIDDLE (GUADALUPIAN)	Capitanian	
		Wordian	
		Roadian	

Figure 5. Stratigraphic position of several brachiopod horizons in the Gua Musang Formation. A – Sungai Galas (Kelantan) and Sungai Yu (Jones *et al.*, 1966), B – Sungai Yu - Merapoh and Sungai Toh (Mohd Shafeea Leman, 1993, 1994), Sungai Toh (Campi *et al.*, 2000, 2002), Padang Tengku (Mohd Shafeea Leman 1993, 1995), Penjom (this paper), Sungai Jemuru (Muir-Wood, 1948). All brachiopod horizons are located in northwest Pahang except stated otherwise.

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