

Sedimentological and palaeontological study along the Kuala Tekai-Kuala Tahan stretch of Tembeling River, Jerantut Pahang

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Abstract: The rock succession which is exposed along the riverbank from Kuala Tekai to Kuala Tahan of Tembeling River was mapped and interpreted by previous workers as part of the Semantan Formation. However, detailed sedimentological and palaeontological study which was carried out during this study distinguished the succession into the Semantan Formation and the Mangkin Sandstone Formation of the Tembeling Group. The Semantan Formation consists of three major sedimentary facies, namely; laminated siltstone interbedded with shale facies, laminated carbonaceous shale facies, and graded bedding sandstone facies. Four major sedimentary facies were identified in the rock succession of the Mangkin Sandstone Formation. These are pebbly sandstone interbedded with sandstone facies, massive sandstone facies, interbedded sandstone and siltstone facies and interbedded sandstone and mudstone facies. The discovery of fairly well-preserved palynomorphs in the studied rock succession can be utilised in interpreting the age of the rocks. Some twenty palynomorph taxa were identified which include *Retitriletes circolumenus*, *Lycopodiumsporites* sp., *Lycopodiumsporites eminulus*, *Klukisporites variegatus*, *Neoraistrickia truncates* and *Cyathidites punctatus*. The identified palynomorph assemblage is comparable to *Stylosus* Assemblage of Neocomian-Aptian age.

Abstrak: Jujukan batuan yang tersingkap di sepanjang tebing Sungai Tembeling dari Kuala Tekai ke Kuala Tahan telah dipetakan dan ditafsirkan oleh pengkaji terdahulu sebagai Formasi Semantan. Walau bagaimana pun, kajian sedimentologi dan paleontologi terperinci yang dijalankan sekarang membahagikan jujukan batuan tersebut kepada Formasi Semantan dan Formasi Batu Pasir Mangkin dari Kumpulan Tembeling. Formasi Semantan terdiri daripada tiga fasies sedimen yang utama iaitu fasies selang lapis lodak berlamina dengan syal, fasies syal berkarbon berlamina dan fasies batu pasir berpelapisan berperingkat. Empat fasies sedimen yang utama telah dikenal pasti dalam jujukan batuan Formasi Batu Pasir Mangkin. Fasies sedimen tersebut ialah fasies selang lapis batu pasir berpebel dan batu pasir, fasies batu pasir masif, fasies selang lapis batu pasir dan batu lodak dan fasies selang lapis batu pasir dan batu lumpur. Penemuan palinomorff yang terawet sederhana baik dalam batuan yang dikaji boleh digunakan dalam membuat tafsiran usia batuan tersebut. Lebih kurang dua puluh taksa palinomorff telah dikenal pasti termasuklah *Retitriletes circolumenus*, *Lycopodiumsporites* sp., *Lycopodiumsporites eminulus*, *Klukisporites variegatus*, *Neoraistrickia truncates* dan *Cyathidites punctatus*. Himpunan palinomorff yang dikenal pasti mempunyai persamaan dengan Himpunan *Stylosus* yang berusia Neocomian-Aptian.

INTRODUCTION AND GEOLOGICAL SETTING

The study area is located approximately 60 km to the north of Jerantut, Pahang (Figure 1). This study focusses on the sedimentological and palaeontological aspects of the sedimentary rocks, with the aim in interpreting their depositional environment and their ages, based on palynological evidence. To date, no comprehensive study on the depositional environment and age determination of the rock succession in this part of the Tembeling River. Previous workers interpreted this area is part of the Semantan Formation. The present study is able to divide this area into the Semantan Formation and Mangkin Sandstone Formation of the Tembeling Group. It is found that the contact between these two formations is a fault contact. The Semantan Formation sits on the Mangkin

Sandstone Formation as a result of tectonic activity during Upper Triassic as interpreted by many previous workers. The Semantan Formation was proposed by Jaafar Ahmad (1976) which is characterised by the dominant of interbedded shale and tuffaceous sandstone, conglomerate, limestone lenses and chert of Middle to Upper Triassic age. This rock sequence is widely-distributed in the central part of Peninsular Malaysia, and it is interpreted to be deposited in a deep sea environment. The Tembeling Formation was introduced by Koopmans (1968) to consists of conglomerate, quartzitic and feldspathic sandstone, shale, and siltstone of Upper Triassic to Jurassic age. The Mangkin Sandstone is characterised by well-developed cross bedding which suggests that it may have deposited within continental setting. The upper boundary of the Semantan Formation was located anywhere in the study area. Many workers interpreted that the contact

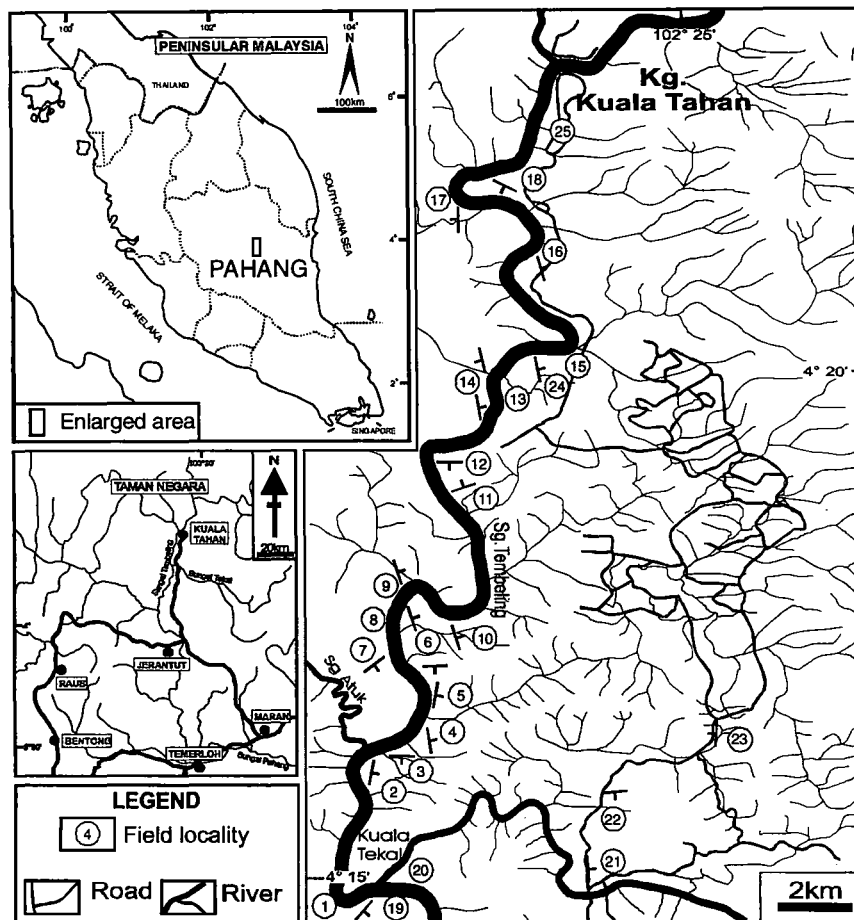


Figure 1: Study area

between the Semantan and the Tembeling Group is an angular unconformity.

Some palynomorph discoveries were reported by previous workers from the surrounding areas. Spore and pollen such as *Classopollis classoides* and *Circulina* sp. of Jurassic age were recorded along the Tekai River by Koopmans (1968). Harbury et al. (1990) have recorded some pollen of Jurassic-Cretaceous age in the Termus Shale Formation. The occurrence of *Clavatipollenites* sp. have also been reported from the central part of Pahang (Shamsudin Jirin and Morley, 1994) and it was also recorded in the southeastern part of Pahang (Uyop Said, 2002). The recent study by Mohd. Rizaini Mat Riffim (2003) interpreted the age of the area around Kuala Tahan is Early Cretaceous to Late Early Cretaceous based on palynomorphs *Gleicheniidites delicatus* (Bolckhotivina) Pocock 1970, *Equisetoporites ambiguus* (Hedlund) Singh 1983, *Classopollis martinotti* Reyer 1970, *Cyathidites minor* Couper, dan *Perotriletes monstrum* sp.

MATERIALS AND METHODS

The rock succession was measured and systematic sampling was also carried out. The most suitable samples for palynological study are siltstone and fine grained sandstone which are rich in carbonaceous materials. A

total of 39 samples were collected and processed according to the standard palynological preparation techniques for palynological study. The organic residues were mounted in a permanent medium of Canada Balsam onto glass slides to be examined under transmitted light microscope. The palynomorphs were then identified by comparing with other palynomorphs which were recorded from other areas by previous workers.

RESULT AND DISCUSSION

Based on lithology and sedimentary structure, the rock succession belong to the Semantan Formation in the study area can be divided into three major facies. These are:

Facies A: Laminated siltstone interbedded with shale. This facies is characterised by laminated siltstone interbedded with shale and interbedded sandstone and mudstone which were deposited in the fan's superlobe environment (Figure 2). The high tuffaceous content shows that it was deposited before or during active volcanic activity of Triassic. The occurrence of the rhyolite is also an evidence that the volcanic activity had taken place in this area.

Facies B: Laminated carbonaceous shale. It is characterised by the dominant of laminated carbonaceous

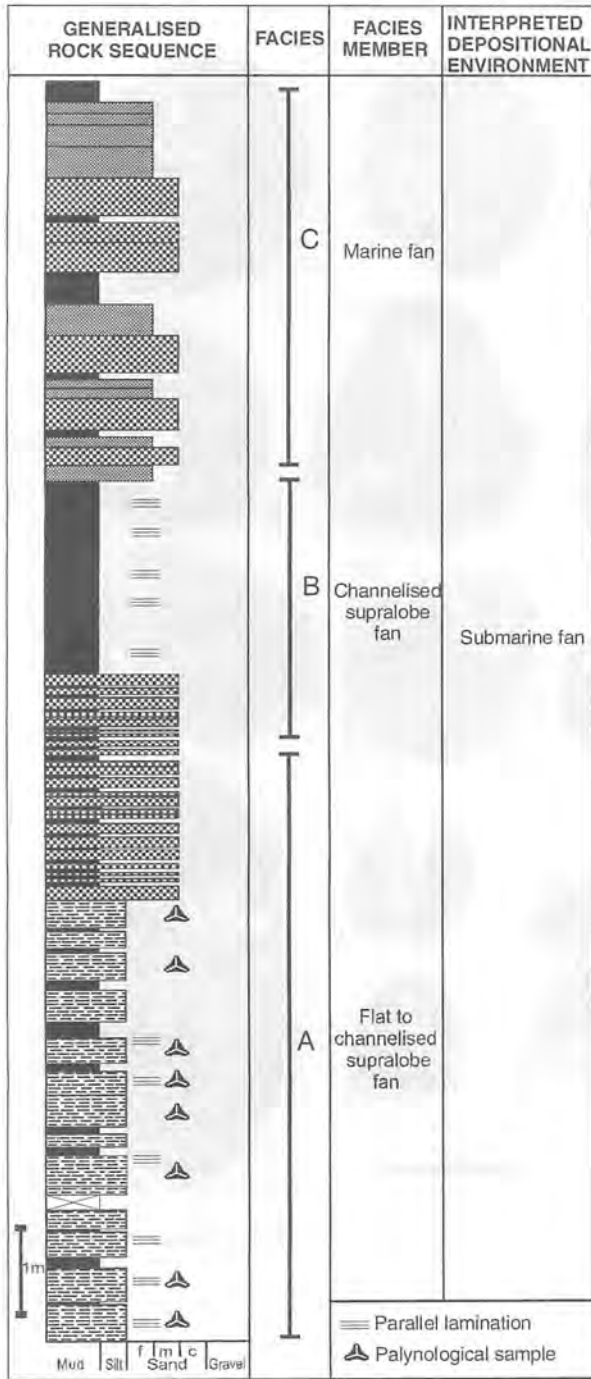


Figure 2: Generalised rock sequence of the Semantan Formation in the study area.

shale interbedded with sandstone and mudstone, and it is interpreted that this rock succession was deposited in the fan's superlobe environment (Felix Tongkul, 2000) .

facies, it is interpreted that it was deposited in the upper fan environment.

Based on the lithofacies analysis, it is interpreted that the rock succession of the Semantan Formation was deposited in a deep sea environment as suggested by previous workers. This rock succession is also characterised by the presence of tuff, carbonaceous

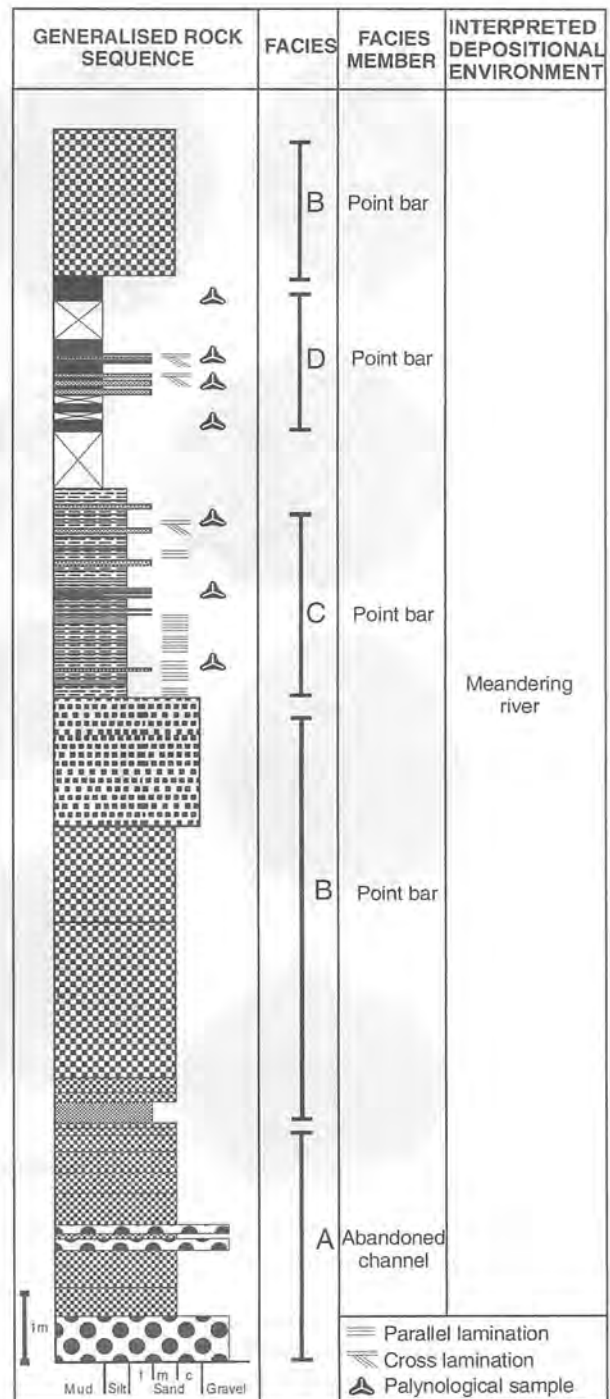


Figure 3: Generalised rock sequence of the Mangkin Sandstone Formation in the study area.

materials and sandstone which ranging from subgreiwacke to greywacke and the absence of cross bedding.

Facies C: Graded bedding sandstone. This facies is dominated by the sandstone with well-developed sedimentary structure of graded bedding. Based on the lithology and the sedimentary structure observed in this

Four major sedimentary facies were identified in the rock succession of the Mangkin Sandstone Formation. These are:

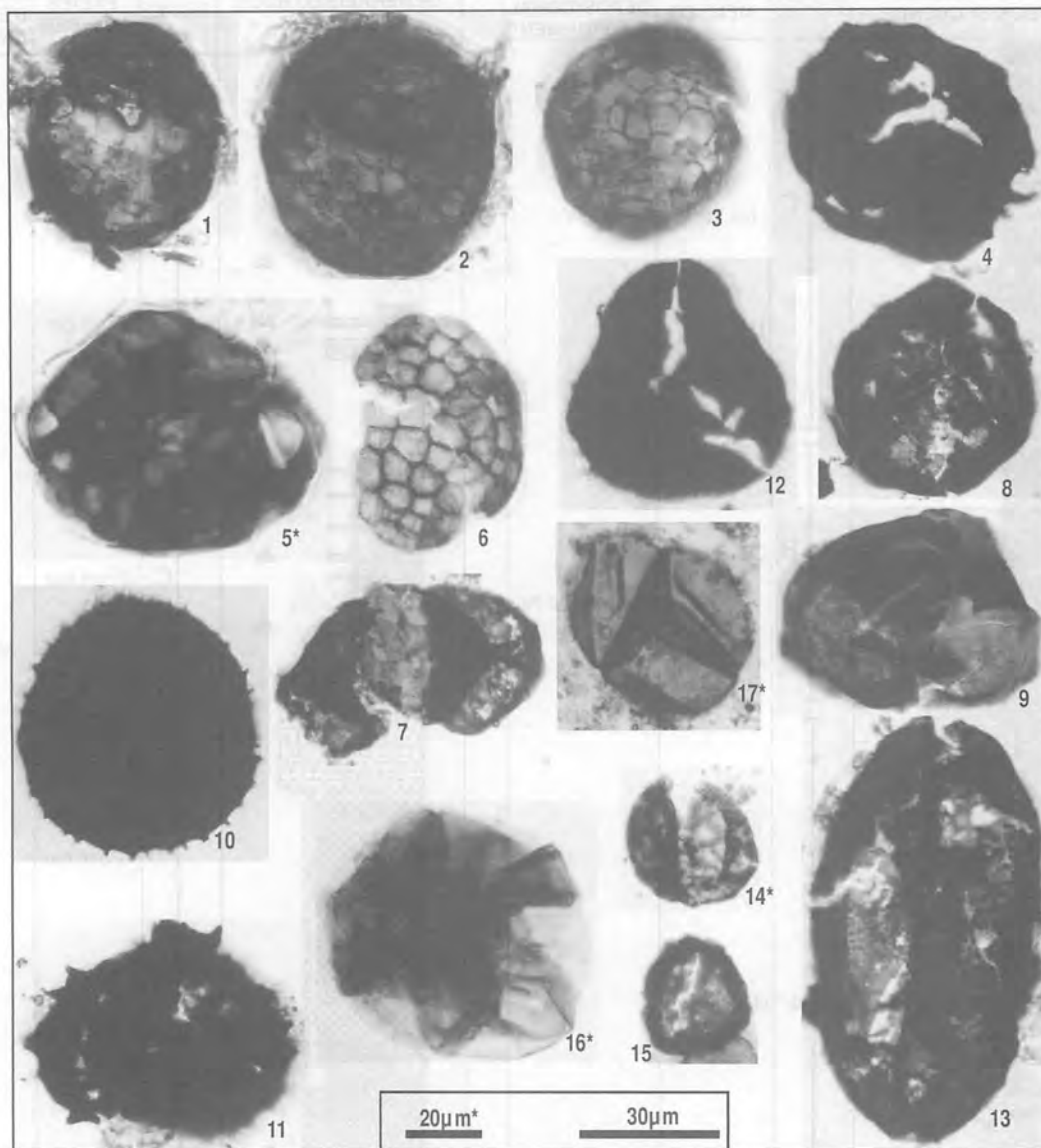


Figure 5: Illustration of the identified palynomorphs from the study area (All photographs are taken under transmitted light microscope).

1. *Lycopodiumsporites* sp.
2. *Lycopodiumsporites* sp.
3. *Lycopodiumsporites* sp.
4. *Lycopodiumsporites eminulus*
5. *Klukisporites variegatus* Couper 1958
6. *Lycopodiumsporites* sp.
7. *Alisporites similis*
8. *Retitriletes circolumenus*
9. *Araucariacites australis* Cookson 1947
10. *Ceratosporites helidonensis* Cookson & Dettman 1958
11. *Neorastrickia truncatus* (Cookson) Potonié 1956
12. *Cyathidites punctatus*
13. (?)*Ovalipollis lunzensis*
14. *Taxodiaceapollenites* sp.
15. *Duplexisporites* sp.
16. (?)*Ashmoripollis reducta*
17. *Ericales* sp.

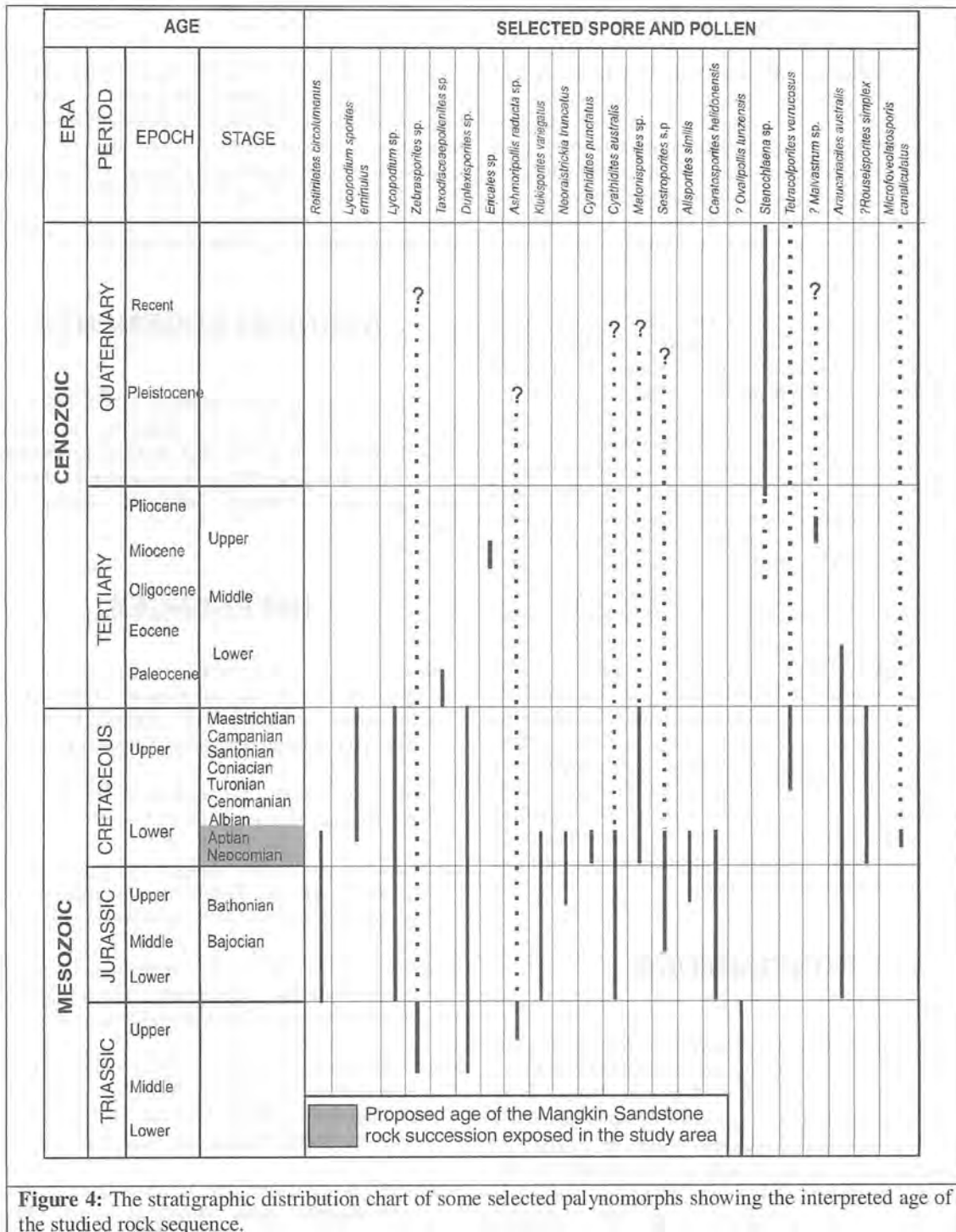


Figure 4: The stratigraphic distribution chart of some selected palynomorphs showing the interpreted age of the studied rock sequence.

Facies A: Pebbly sandstone interbedded with sandstone. This facies is dominated by the pebbly sandstone interbedded with medium-grained sandstone which is interpreted to be deposited in an abandoned channel (Figure 3). The presence of pebbly sandstone indicates the variation in current flows affecting the supply of sediments into the sedimentary basin.

Facies B: Massive sandstone. This facies is characterised by massive sandstone which consists of

feldspathic greywacke which is interpreted to have been deposited in a point bar environment.

Facies C: Interbedded sandstone and siltstone. It is characterised by alternation of sandstone and siltstone layers of various thicknesses. Sedimentary structures such as parallel laminations, cross laminations and cross bedding are commonly found in this facies.

Facies D: Interbedded sandstone and mudstone. The dominant lithology in this facies differs with the facies C

by the presence of mudstone layers. The sedimentary structures identified in this facies closely resembles with that of the facies C. And therefore, this facies is also interpreted to be deposited in the point bar environment.

In general, it is interpreted that the Mangkin Sandstone Formation was deposited in a braided river system. The rock sequence clearly shows a fining upward sequence. The presence of sedimentary structures such as parallel laminations, cross laminations and cross bedding indicates that the environment of deposition is a fluvial environment.

A total of 25 samples yielded palynomorphs at different stages of preservation. Only a few samples yield either badly preserved palynomorphs or unidentifiable plant fragments. The observed palynomorphs genera were assigned to *Retitriletes circolumenus*, (?)*Zebrasporites* sp., *Taxodiaceapollenites* sp., *Duplexisporites* sp., *Phaeoceros bulbiculosus*, (?)*Ashmoripollis reducta*, *Ericales* sp., *Lycopodiumsporites* sp., *Lycopodium sporites eminulus*, *Klukisporites variegatus*, *Neoraistrickia truncatus*, *Cyathidites punctatus*, *Cyathidites australis*, *Matonisporites* sp., *Sestroporites pseudoalveolatus*, *Ceratoporites helidonensis*, *Alisporites similis*, (?)*Ovalipollis lunzensis*, *Stenochlaena* sp., *Tetracolporites verrucosus*, (?)*Malvastrum* sp., *Microfoveolatosporis canaliculatus*, *Araucariacites australis*, dan (?)*Rouseisporites simplex*. Some selected palynomorphs which were identified in this study are illustrated in Figure 5. These genera were found in the Mangkin Sandstone Formation except for the species (?)*Malvastrum* sp. which was the only palynomorph found in Semantan Formation. Based on the presence of the palynomorphs, it is interpreted that the identified palynomorph assemblage in of the Mangkin Sandstone Formation shows a close resemblance to the *Stylosus* Assemblage (? Neocomian-Aptian).

CONCLUSIONS

The acquired sedimentological and palaeontological data from the outcrops along the riverbank from Kuala Tekai to Kuala Tahan stretch of Tembeling River can be utilised in interpreting the age and the environment of deposition of the studied rock succession. In general, the rock succession in the study area can be divided into the Semantan Formation and the Mangkin Sandstone Formation of the Tembeling Group. The Semantan Formation of Middle Triassic to Upper Triassic age is interpreted to be deposited in a deep sea environment and it can be divided into three major sedimentary facies. The identified sedimentary facies are laminated siltstone interbedded with shale facies, laminated carbonaceous shale facies, and graded bedding sandstone facies. The Mangkin Sandstone Formation consists of four major sedimentary facies namely, pebbly sandstone interbedded

with sandstone facies, massive sandstone facies, interbedded sandstone and siltstone facies and interbedded sandstone and mudstone facies. Based on the sedimentary facies and the sedimentary structures observed, it is interpreted that the Mangkin Sandstone Formation was deposited in a meandering river system of fluvial environment. The identified palynomorph assemblage in the rock succession of the Mangkin Sandstone Formation shows a close resemblance to that of *Stylosus* Assemblage of Lower Cretaceous age (?Neocomian-Aptian).

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