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Jurassic-Cretaceous continental deposits from Eastern Chenor, Pahang

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Abstract: A detailed sedimentological study has been carried out on the rock succession exposed at several road cuts along the road from Kampung Pejing to Kampung Lotong located in the east of Chenor, Pahang. The studied rock succession can be divided into four sedimentary facies, namely the sandstone with conglomerate lenses facies, the siltstone with minor sandstone facies, the thickly bedded sandstone facies and the interbedded sandstone with siltstone facies. The palaeoenvironments of deposition for each of the facies are described. It shows a close resemblance with the Mangkin Sandstone Formation in The Tembeling Group of Late Jurassic-Early Cretaceous age, which was interpreted to be deposited in an alluvial fan system.

Abstrak: Kajian sedimentologi secara terperinci telah dijalankan terhadap jujukan batuan yang tersingkap di beberapa potongan jalan dari Kampung Pejing hingga Kampung Lotong yang terletak di bahagian timur Chenor, Pahang. Jujukan batuan yang dikaji dapat dibahagikan kepada empat fasies iaitu fasies batu pasir dengan kekanta konglomerat, fasies batu lodak dengan sedikit batu pasir, fasies batu pasir berpelapisan tebal dan fasies selang lapis batu pasir dengan batu lodak. Sekitaran pengendapan bagi setiap fasies diterangkan. Jujukan ini mempunyai persamaan yang jelas dengan Formasi Batu Pasir Mangkin dalam Kumpulan Tembeling berusia Jura-Kapur yang ditafsirkan telah terendap di sekitaran kipas aluvium.

INTRODUCTION

Jurassic-Cretaceous sedimentary rocks are widespread in the central part of Peninsular Malaysia and some of them were mapped as the Tembeling Group (Khoo, 1977). They are part of the Mesozoic sedimentary rocks in Peninsular Malaysia which were described by Burton (1973) and Khoo (1983). The Tembeling Group was formerly known as the Tembeling Formation which was introduced by Koopmans (1968) and it consists of four formations. They are in ascending order, the Kerum Formation, Lanis Conglomerate Formation, Mangkin Sandstone Formation and Termus Shale Formation. However, the Kerum Formation shows no typical characteristics of continental deposits as it consists of interbedded tuffaceous sandstone, shale and siltstone which were deposited in a marine environment. The Kerum Formation closely resembles the Middle Triassic rocks of the Semantan Formation (Harbury *et al*., 1990). In general, The Mangkin Sandstone Formation consists of quartz sandstone interbedded with red and grey siltstone of 2000 m in thickness and it was interpreted as Jurassic-Cretaceous age by the presence of the plant fossil *Gleichinoides gagauensis* (Khoo, 1983).

Based on the lithology, the rock succession in the study area (Figure 1) closely resembles the Mangkin Sandstone Formation in the Tembeling Group. The rock succession is predominantly red and grey in colour as is often related to the oxidation process on the continental deposits.

MATERIAL AND METHOD

The rock succession was measured at 11 localities along the road from Kampung Pejing to Kampung Lotong and 52 samples were collected. Some outcrops are extremely weathered and on some occasions, it was difficult to determine the bedding of the rocks. All the

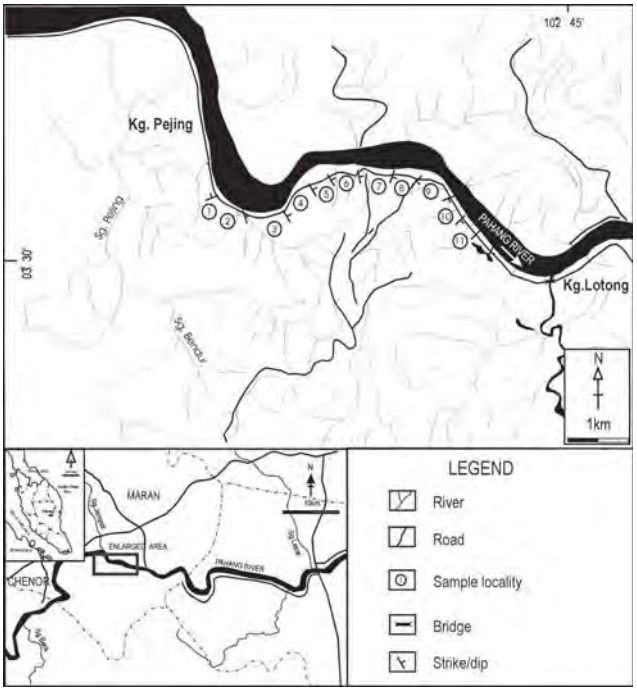

Figure 1: Location map of the study area.

geological data at each available outcrop were recordedfor further analysis. The samples collected were then prepared for petrological and palynological studies. However, this paper will only emphasise the sedimentological aspects of the rock succession in the study area which resembles the Mangkin Sandstone Formation.

RESULT AND DISCUSSION

The rock succession in the study area can be divided into four main facies namely the sandstone with conglomerate lenses facies, the siltstone with minor sandstone facies, the thickly bedded sandstone facies and the interbedded sandstone with siltstone facies. Each facies is described below.

Sandstone with conglomerate lenses facies

This facies was only found in the western part of the study area located near Kampung Pesagi. The facies is dominated by red coloured sandstone with conglomerate lenses. The total thickness of this facies is 50 m (Figure 2A). The conglomerate lenses were identified as channelised conglomerate (Figure 2A1) and they were found to be stacking-up on top of each other (Figure 2A2). Thin layers of mud between sandstone layers and conglomerate layers were also found. The grain size of the sandstone in this facies varies from fine to coarse, and pebbly sandstone layers were also present at certain horizons. The pebbly sandstone layers were commonly found at the bottom of the succession together with the conglomerate units as lenses and channels. In comparison, the upper part of the succession is dominated by the relatively finer grained sandstone layers. Cross bedding is a common sedimentary structure in sandstone layer (Figure 2-A3). The sediments were deposited in an alluvial fan environment that was influenced by water flow that produced cross beddings in the sandstone layers. The sandstones are interpreted to be deposited in the distal part of the alluvial fan. Channelised layers of conglomerate are interpreted as channel deposits which were deposited during heavy rain.

Siltstone with minor sandstone facies

This facies is dominated by siltstone which is 1 to 2 m thick and is only observed in the eastern part of the study area, overlying the sandstone with conglomerate lenses facies. The dominantly argillite rocks succession is red and grey in colour (Figure 2B1), and at certain horizons, interbedded thin layers of siltstone with sandstone can also be found. The sandstone is less dominant in this facies and it normally occurs interbedded with siltstone layers in the middle part of the succession. Most of the sandstone layers are approximately 10-50 cm thick but the thickness may reach up to 1 m in several horizons. At certain horizons mudstone layers about 5-10 cm thick occur within the relatively coarser grained sandstone layers. The presence of a thin layer of mud shows it was caused by a prograding process of sedimentation. However most of the outcrops of this facies are weathered and it was extremely difficult to ascertain the sedimentary structures in this facies. This facies is related to the flooding period, during which the suspended finer sediments were deposited along the main channel. The total thickness of this facies is approximately 90 m (Figure 2B).

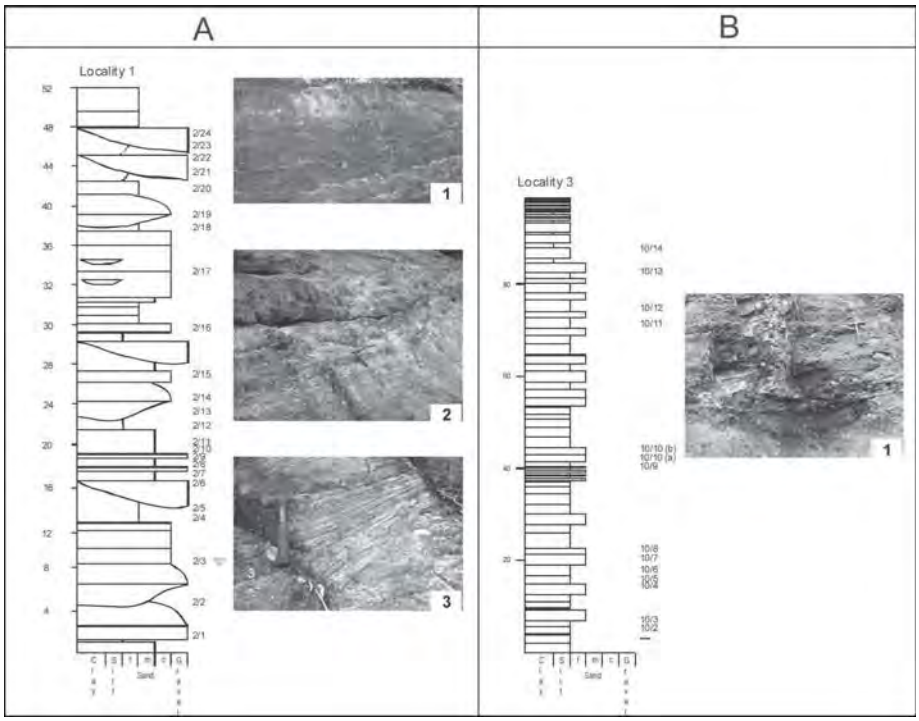

Figure 2: The measured rock successions showing the sandstone with conglomerate lenses facies (A) and the siltstone with minor sandstone facies (B). Field photographs showing some characteristics of each facies.

Thickly bedded sandstone facies

This facies is located in the middle part of the rock succession in the study area, and it is characterised by white and grey sandstone layers about 1-2 m thick (Figure 3A1 and 3A2). Based on the grain size, the sandstone in this facies can be divided into fine-grained sandstone, medium-grained sandstone and coarse-grained sandstone. Cross bedding is commonly found in the lower part of the succession. Based on the presence of the cross bedding and the dominance of sandstones, this facies is interpreted to be deposited in an environment which was influenced by continuous currents such as in the main channel. The total thickness of this facies is approximately 90 m (Figure 3-A).

Interbedded sandstone with siltstone facies

In general, the interbedded sandstone with siltstone facies was mainly observed in the middle part of the study area. The red and grey sandstone units in this facies are mostly fine-grained sandstone to medium-grained sandstone. They are mainly 10-20 cm thick and interbedded with siltstone (Figure 3B1). The sandstone layers may reach up to 2 m thick in certain horizons. There are several thinly bedded mudstone layers in the middle part of the succession. Parallel laminations are commonly found in siltstone and fine-grained sandstone layers especially in the lower part of the succession. The total thickness of this facies is approximately 25 m (Figure 3B). The presence of parallel laminations suggests that the sediments were deposited in a low energy environment as such as in the distal part of the alluvial fan system.

Facies distribution

A detailed mapping on the sedimentary facies shows that the sandstone with conglomerate lenses facies occupies the western part of the study area and it is overlain by siltstone with minor sandstone facies. The middle part of the study area is dominated by the thickly bedded sandstone facies followed by the interbedded sandstone with siltstone facies, and in certain places, repetition of the identified facies is common. A sketched map of the facies and the W-E cross section of the study area are shown in Figure 4-B and 4-C respectively.

Based on the facies analysis and the facies distribution as compared to that of Tucker (1995) and Prothero and Schwab (2004), it is interpreted that the studied rock succession was deposited in a continental environment. The overall succession is dominated by sandstones of various grain sizes (Figure 4A), which indicates that the sediments were undergoing progradation in west-northwesterly direction when deposited (based on palaeocurrent study by Marahizal Malihan, 2006). Fining upwards sequences are commonly found in the channel deposits. The most suitable environment for the studied rock succession is an alluvial fan system. In an alluvial fan environment, the velocity of the flow is relatively high enabling coarse grained sediments such as gravel and sand to be transported and subsequently deposited. Pebbles in the pebbly sandstone layers were transported by traction currents, especially in the bottom of the channel. In comparison, mud and finer sediments were deposited in low energy environments such as lakes and floodplains in the distal part of the alluvial fan system.

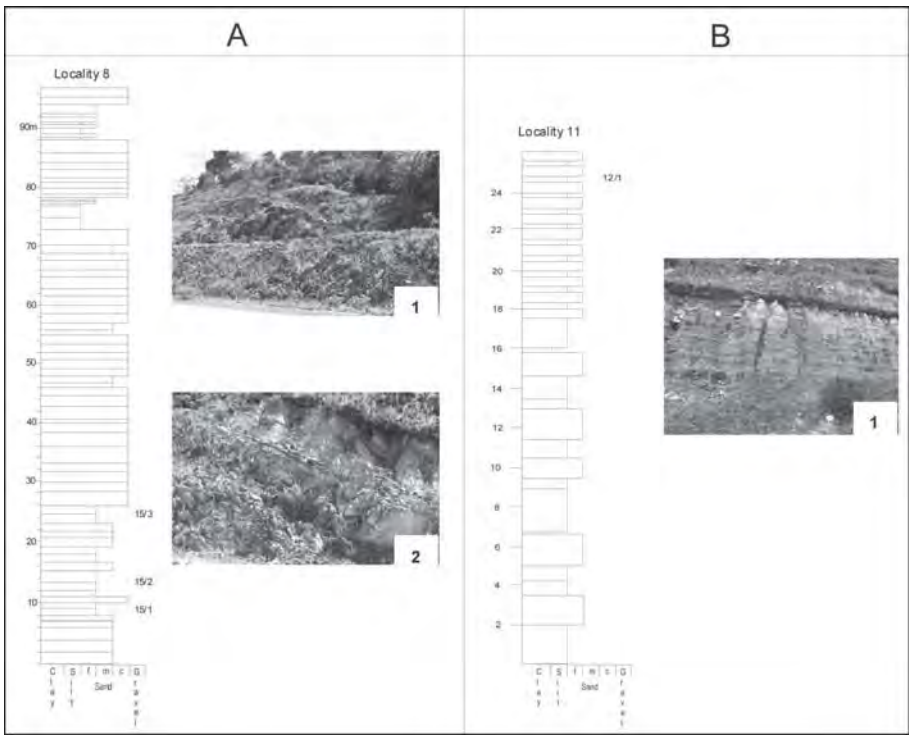

Figure 3: The measured rock successions showing the thickly bedded sandstone facies (A) and interbedded sandstone with siltstone facies (B). Field photographs showing some characteristics of each facies.

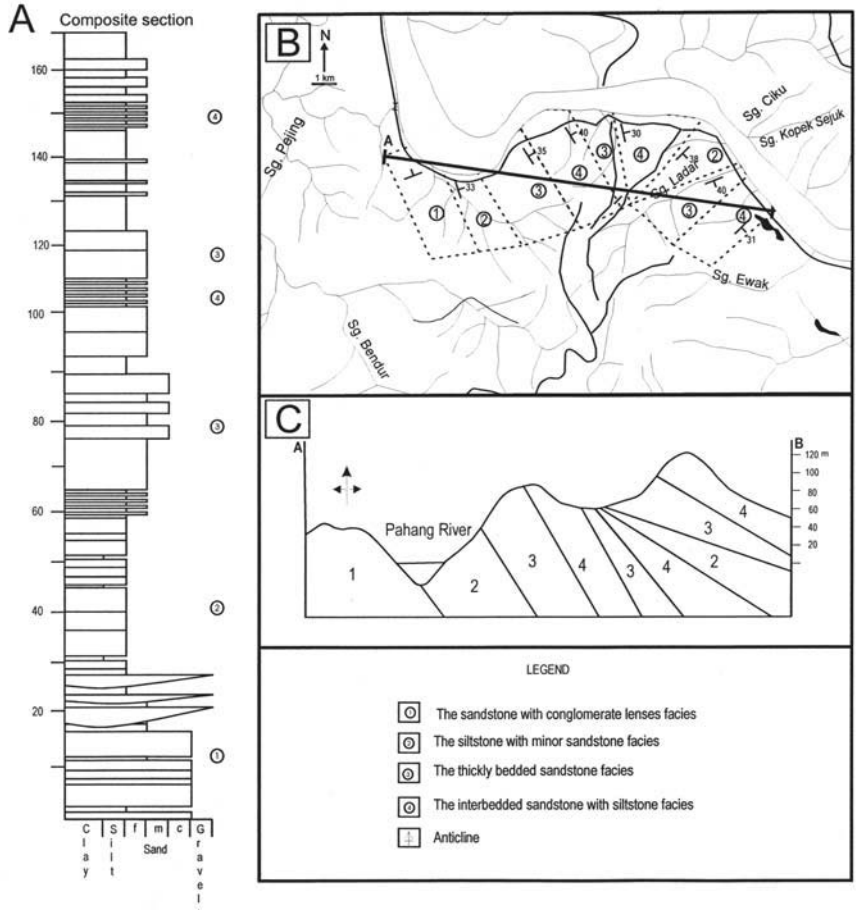

Figure 4: Overall section of the studied rock succession (A), sketched facies map (B) and the W-E cross section of the study area.

CONCLUSION

Based on sedimentological study, the rock succession from Kampung Pejing to Kampung Lotong, Maran, Pahang shows a close resemblance to the Mangkin Sandstone Formation of the Tembeling Group of Jurassic-Cretaceous age. Four sedimentary facies were identified, they are the sandstone with conglomerate lenses facies, the siltstone with minor sandstone facies, thickly bedded sandstone facies and the interbedded sandstone with siltstone facies which were deposited in an alluvial fan environment. In general, the rock succession shows a typical fining upwards sequence with repetition of thickly bedded sandstone facies and the interbedded sandstone with siltstone facies at the top.

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