

## Occurrence of slate in Perlis and its significance

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**Abstract**— More than 100 m thick of slate is exposed at an earth quarry of Bukit Tuntung, Pauh, Perlis. The slate comprises quartz, chlorite and muscovite and shows very distinct cleavages. No fossils were discovered from the slate. It is overlain by the bedded chert which is considered as the lowermost part of the Kubang Pasu Formation. The chert contains Early Carboniferous Radiolarians i.e. *Stigmosphaerostylus variospina* (Won) and *Callela hexactina* Won. It can be interpreted that the slate is older than Early Carboniferous. No limestone of the Setul Formation was observed in the vicinity of Pauh. It is therefore, more appropriate to assign the slate as the topmost of Mahang Formation.

**Keywords:** slate, Mahang Formation, Bukit Tuntung, chert, Kubang Pasu Formation

### Kewujudan dan kepentingan batuan sabak di Perlis

**Abstrak**— Lebih daripada 100 m tebal sabak tersingkap di kuari tanah di Bukit Tuntung, Pauh, Perlis. Sabak terdiri daripada kuarza, klorit dan muskovit dan menunjukkan ira yang sangat jelas. Tiada fosil ditemui dalam batuan sabak. Sabak dilapisi di atasnya oleh batuan rijang yang dianggap sebagai bahagian paling bawah daripada Formasi Kubang Pasu. Rijang ini mengandungi radiolaria berusia Karbon Awal seperti *Stigmosphaerostylus variospina* (Won) dan *Callela hexactina* Won. Sabak ditafsirkan lebih tua daripada Karbon Awal. Tiada batu kapur Formasi Setul ditemui berdekatan dengan kawasan Pauh. Oleh itu lebih sesuai batuan sabak ini diletakkan sebagai bahagian teratas Formasi Mahang.

**Kata kunci:** sabak, Formasi Mahang, Bukit Tuntung, rijang, Formasi Kubang Pasu

### INTRODUCTION

Slate forms from the very fine-grained sedimentary rock such as mudstone, which has undergone metamorphism. Slate is a lowest grade of metamorphic rock comprising mainly layered minerals such as illite, kaolinite, chlorite, muscovite and quartz. The rock is characterized by slaty cleavage. It is usually dark in colour and becoming red when weathered.

In Peninsular Malaysia, slate is very common in the Mahang Formation which is mainly exposed in the Mahang area, south Kedah and Sungai Petani area (Burton, 1988). In north Kedah, slate is also found in isolated outcrops exposed at several localities i.e. Pokok Sena, Kota Sarang Semut, Kuari Tunjang, and Kuari Muda.

Recently, we discovered slate in an earth quarry of Bukit Tuntung, Pauh, Perlis. Slate is very rare in Perlis and its occurrence needs further research to be conducted. The aim of this research is to investigate the occurrence, distribution and stratigraphic position of the slate.

### GEOLOGICAL SETTING

Geology of Perlis has been studied by many geologist particularly Jones (1981). He recognized seven rock formations in Perlis. They are (in ascending order) the Machinchang Formation (Cambrian), Setul Formation (Ordovician to Early Devonian), Kubang Pasu Formation

(Late Devonian to Early Permian), Chuping Limestone (Early Permian to Late Triassic), Bukit Arang Tertiary beds and Quaternary alluvium. Granite body is located at the northern tip of Perlis (Figure 1).

The Machinchang and Setul Formations are located at the western part of the state. The Kubang Pasu Formation forms a syncline in the middle of Perlis and the outcrops of the formation are widely exposed (Jones, 1981). The Chuping Limestone forms two north-south oriented ridges (Figure 1). The rocks are slightly folded. The stratigraphic contacts among those formations are generally conformable. To date, no slates were reported from these rock formations and only an isolated outcrop of black indurated mudstone of the Kubang Pasu Formation was observed at the road-cut, at km 7.5 Kaki Bukit-Wang Kelian road.

### DESCRIPTION OF THE OUTCROP

The outcrop of slate is exposed at an earth quarry located at south of Bukit Tuntung, Pauh, Perlis (Figure 2). Bukit Tuntung is a strike ridge with NNE-SSW orientation. The area of the quarry site is approximately 75,000 square meters that exposes three main rock units namely, slate, biogenic chert, and clastic rocks comprises interbedded mudstone and sandstone (Figure 3). The slate occupies slightly more than half of the quarry site and has extensively been excavated. The slate is conformably overlain by bedded chert. The thickness of the chert ranges from 2m to 6m.

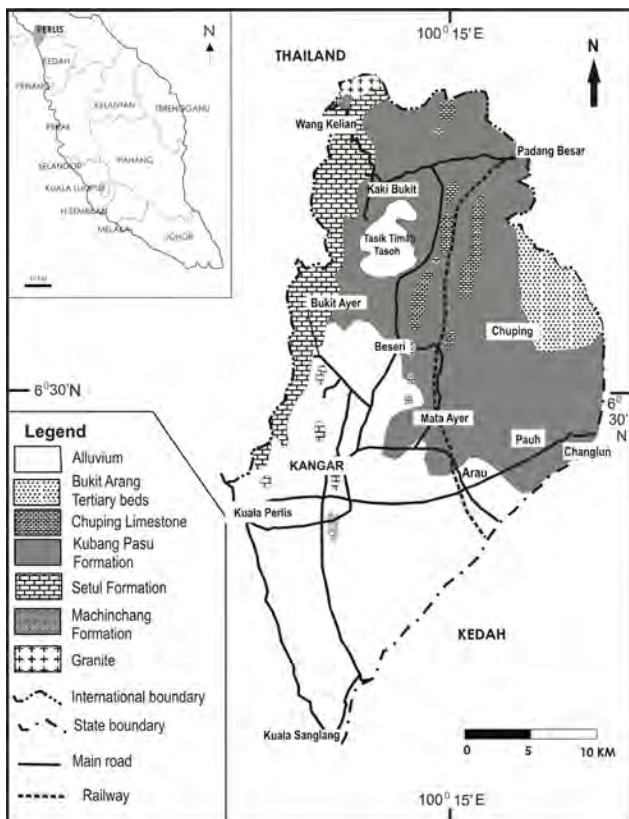


Figure 1: Geological map of Perlis (modified after Jones 1981).

The chert unit is folded due to slumping. The chert unit is overlain by the interbedded mudstone-sandstone unit, indicating a coarsening and thickening upwards sequence. The chert and the interbedded mudstone-sandstone units are considered as a part of Kubang Pasu Formation. Similar rock sequence is also observed at an excavation site closed to Pokok Sena reservoir.

## RESULT AND DISCUSSION

A total of more than 100 m thick of slate is extensively exposed at the quarry. The fresh slate is generally dark green to dark gray in colour. However, near the surface of the quarry the slate has undergone severe weathering and becomes red or reddish brown in colour. The slate exhibits prominent cleavages, which range from 135°/60° to 355°/85°. Thin sections of the slate reveal that the rock is very fine-grained with layered minerals (Figure 4). Ten samples of slate analyzed by using XRD show that the most common minerals are quartz, kaolinite, chlorite (clinochlore), and muscovite.

To date, there is no report on the occurrence slate in Perlis. Discovery of slate at Bukit Tuntung certainly have some geological significance. Thin sections of slate from Bukit Tuntung are comparable to those of the Mahang Formation exposed in Mahang and Sungai Petani areas. Patchy occurrence of slate or highly weathered slate was also observed from various localities in north Kedah, particularly in Kota Sarang Semut, Pokok Sena, Tunjang Quarry, and

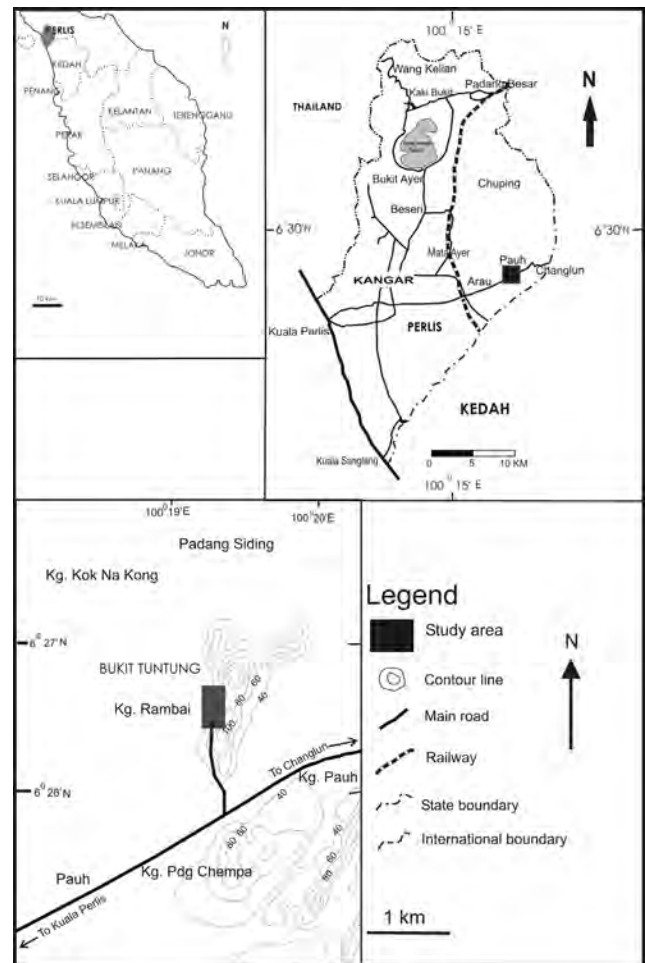
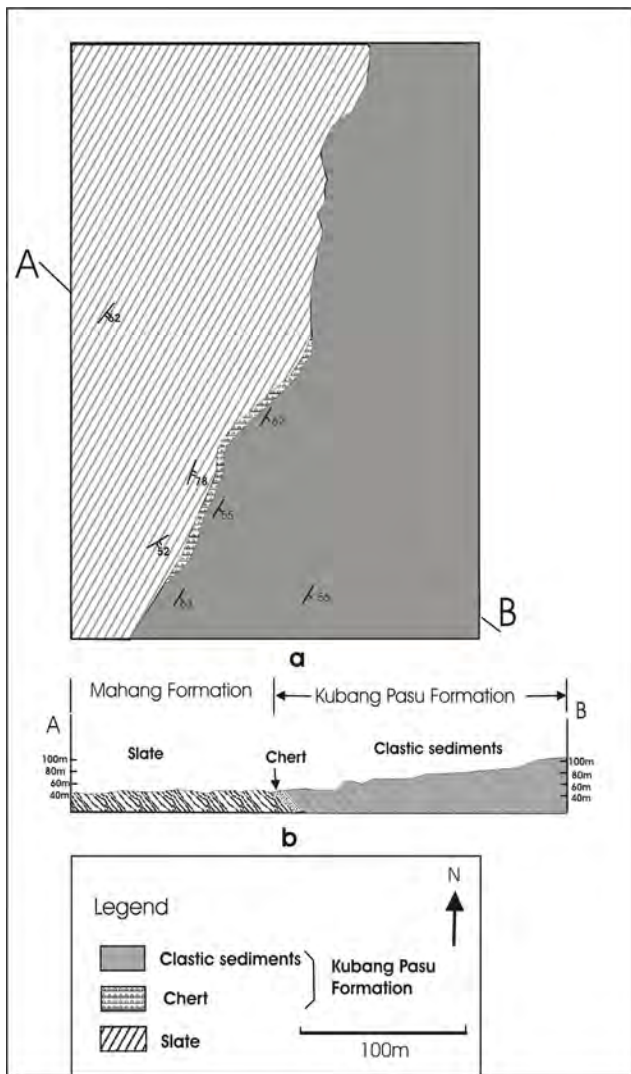


Figure 2: Map showing the study area.

Muda Quarry in vicinity of the Tunjang town (Figure 5).

The key bed, which can be used as a marker to separate the Mahang Formation and the Kubang Pasu Formation, is the chert. The chert from Bukit Tuntung yielded two species of radiolarians i.e. *Stigmosphaerostylus variospina* (Won) and *Callela hexactinia* Won (Figure 6). Similar radiolarian assemblage was also found from Bukit Kamelong and Guar Kepayang. Chert from Bukit Binjal, Kedah yielded nine taxa of radiolarians viz. *Stigmosphaerostylus variospina*, *Entactinia unispina*, *Entactinia inaquoporosa*, *Callela hexactinia*, *Callela cf parvispinosa*, *Trianosphaera hebes*, *Cubaxonium? octaedrospingosium*, *Duplexia foremanae* and *Duplexia parviperporata*. This assemblage is indicative of Tournaisian age (Basir & Zaiton, 2001). The Kubang Pasu chert was also recorded from Pinang Tunggal, Bukit Telaga Jatoh, Bukit Panchor, Kampung Belukar, Ladang Cheong Chong Kaw, Bukit Inas, and Bukit Kelubi (Basir, 1995; Basir, 1999; Basir *et al.*, 2003).

The chert was also recorded from Guar Jentik, Perlis where it overlies the Early Devonian Dacryoconarid bed, which is equivalent to Upper Detrital Member of the Setul Formation (Ong & Basir, 2007). Meor Hakif & Lee (2005) considered the chert as a new lithostratigraphic unit called the Telaga Jatoh Formation. The chert unit is too thin to be considered as a formation and cannot be delineated at the



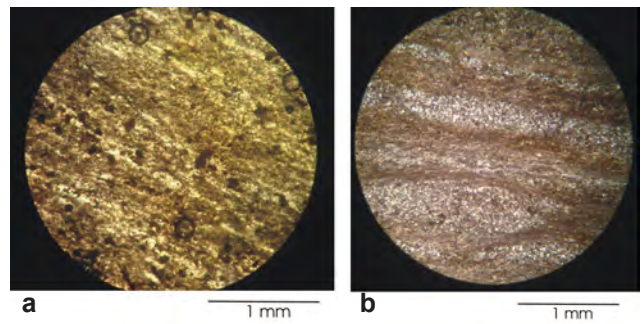
**Figure 3:** Geological map of the Bukit Tuntung quarry. a: Map showing rock units. b: Cross section of the quarry (A-B).

scale of geologic mapping normally practiced in Malaysia (the scale of geological mapping normally practiced in Malaysia is 1: 25,000). The chert is considered to represent the lowermost part of the Kubang Pasu Formation.

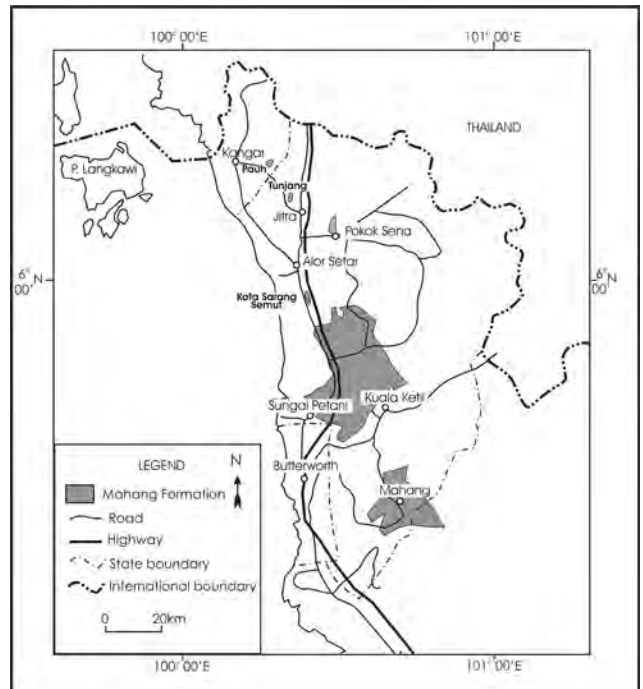
The slate which is exposed at the Bukit Tuntung, Pauh lies below the chert bed and no limestone of the Setul Formation has been observed in the area. Therefore, it is stratigraphically more appropriate to include the slate as a part of the Mahang Formation. Burton (1967, 1988) discovered many fossils such as trilobite, tentaculites and graptolites in the Mahang Formation. Unfortunately, no fossils were recovered from the study area. Most of the fossils have probably been destroyed during the metamorphism.

**CONCLUSION**

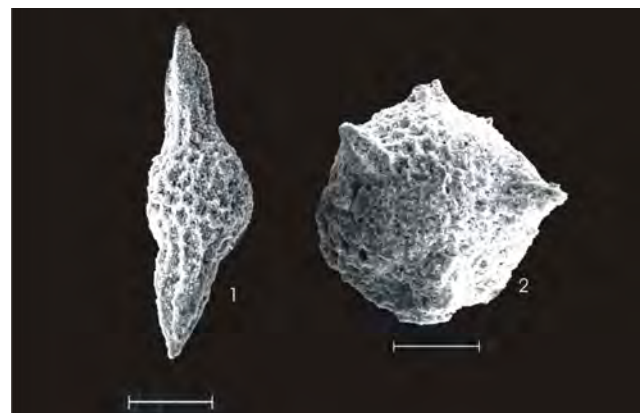
Slate exposed in Bukit Tuntung Quarry, Pauh, Perlis, resembles a part of the Mahang Formation which extends from south Kedah further north to Perlis. This is the first record the occurrence of Mahang Formation in Perlis. The



**Figure 4:** Photomicrographs of slate. a: Showing parallel orientation of flaky minerals forming cleavage. b: Composition of slate; microcrystalline quartz and flaky minerals (chlorite and muscovite).



**Figure 5:** Map showing distribution of the Mahang Formation in Kedah and Perlis.



**Figure 6:** Early Carboniferous radiolarians retrieved from the chert of Bukit Tuntung (scale bar is indicated in parentheses). 1. *Stigmosphaerostylus varius pina* (Won)( 100 µm); 2. *Callella hexactina* Won (100 µm).



boundary between the Mahang Formation and Kubang Pasu Formation is well-exposed at the quarry. The chert bed is considered as a marker bed, which can be used to mark the lower boundary of the Kubang Pasu Formation. In north Kedah and Perlis, the Mahang Formation is conformably overlain by the Kubang Pasu Formation and occasionally discovered by extensive excavation at the quarry sites. The slate at Bukit Tuntung represents the top part of Mahang Formation which is equivalent to the top part of the Setul Formation.

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