

Sedimentology, stratigraphy and paleontology of Pulau Jemuruk, Langkawi

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The oldest known rock formation in Malaysia is the Machinchang Formation, the top of which is exposed at Pulau Jemuruk and the surrounding Teluk Kubang Badak in Langkawi. The geology of Pulau Jemuruk and Teluk Kubang Badak is mainly made of medium- to fine-grained sandstone, interbedded with siltstone and shale. The strata is dipping from 10° to 15° towards the E-SE direction, forming several fining upward sequences. The fine-grained sandstone, siltstone and shale within 2 m intervals below each flooding surfaces often yield various kind of fossils, mostly ichnofossils. Fossils were also discovered from the sandstone at the lower interval of the fining upward sequence.

Although the main fossil constituents are trace fossils, the discovery of several species of trilobites and brachiopods is very important for interpretation of the age and depositional environment of the upper part of Machinchang Formation. Among fossils found are trilobite *Saukia* sp., ?*Saukioides* sp., ?*Acontheus* sp. and *Eosaukia* sp., brachiopod ?*Eoorthis* sp. and ichnofossil *Phycodes pedum* SEILACHER, *Teichichnus stellatum* BALDWIN, *Palaeophycus* sp., *Dictyodora* sp., *Chondrites* sp., *Palaeodictyon* sp., *Arenicolites* sp., *Planolites* sp., *Thalassinoides* sp. and *Skolithos* sp.

Saukiid trilobites and orthid brachiopods were previously recorded in the Upper Cambrian of Thailand, China and several other Asian countries, thus confirming an Upper Cambrian age for the upperpart of Machinchang Formation. Some of the ichnogenera and species are also commonly known in Lower Paleozoic rocks. The ichnogenera consists of both dwelling and grazing forms suggesting various environmental regimes.

Table 1. Stratigraphic and spatial distribution of species found at Pulau Jemuruk.

SPECIES	AGE RANGE	DISTRIBUTION
TRILOBITE <i>Saukia</i> sp. ? <i>Saukioides</i> sp. ? <i>Acontheus</i> sp. <i>Eosaukia</i> sp.	Upper Cambrian Upper Cambrian ?Middle Cambrian Upper Cambrian	Asia, North America East Asia Europe Asia
BRACHIOPOD ? <i>Eoorthis</i> sp.	Upper Cambrian	Asia, North America
ICHNOFOSSIL <i>Phycodes pedum</i> SEILACHER <i>Teichichnus stellatum</i> BALDWIN <i>Palaeophycus</i> sp. <i>Dictyodora</i> sp. <i>Chondrites</i> sp. <i>Palaeodictyon</i> sp. <i>Arenicolites</i> sp. <i>Planolites</i> sp. <i>Thalassinoides</i> sp. <i>Skolithos</i> sp.	Cambrian ?Paleozoic wide range Cambrian to Carboniferous wide range wide range wide range wide range wide range wide range	Asia ?Europe cosmopolitan Asia, Europe cosmopolitan cosmopolitan cosmopolitan cosmopolitan cosmopolitan

Based on the fauna and lithological succession, it can be interpreted that the Upper Cambrian of Pulau Jemuruk and Teluk Kubang Badak was deposited in a shallow marine environment, from an open shelf to a rather confined basin influenced by the shifting of barrier bars. The shelf was also influenced by cyclical transgression as exhibited by the fining upward sequences. The whole succession was formed during a major transgression period, where the shallow marine Jemuruk sequence succeeded a continental deposits of the middle member of Machinchang Formation. This Upper Cambrian shallow marine clastic is then overlain by the Ordovician limestone of Setul Formation. A transitional boundary between the clastic sequence to limestone sequence can be observed at Tanjung Sabung, east of Pulau Jemuruk.
