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# The Sauropod Dinosaur Trackways from Tanah Merah, Kelantan, Malaysia

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**Abstract.** A newly discovered giant Sauropod trackways from Bukit Panau Hill, Tanah Merah District in Kelantan reveals that northern Kelantan was inhabited by dinosaur 65 to 144 million years ago probably in the Cretaceous period. The purpose of this paper is to introduce the discovery of the first Sauropod fossil in Malaysia and is also a preliminary study of the existence of Sauropod in Malaysia in particular. At least 7 tracks averagely 66 cm in wide and 72 cm in length are within the size range of large cretaceous sauropods such suggests an animal reaching a length of 22 meter long and 9 meters high, with weight estimated 30 to 40 metric tons.

## 1. Introduction

Tanah Merah district has become the focus of geologists from Thailand and Malaysia since 2006 when they carried out a geological study of the border between those two countries. The most interesting geological phenomenon is the Panau Bed in the Bukit Panau, since the similar rock formation, Khlong Min Formation, in Thailand contains dinosaurs fossil [1]. Through plant fossils found, the Panau Bed is believed to be Cretaceous in age and was deposited on land environments.

Efforts to find out the dinosaurs fossils in the Bukit Panau area has been done by a number of geologists, including the Final Year geoscience students from University Malaysia Kelantan and local geology authority, in the Bukit Panau area. However, until we wrote this report such fossils have never been found.

In the Late May 2017, researchers from Geoscience Department from Universiti Malaysia Kelantan found a track sites of dinosaur in the Bukit Panau. This track site included abundant footprints of Sauropod dinosaurs. The outcrop where Sauropod found spanned approximately 400 square meters and included at least 7 individual footprints.

This finding is a recent discovery of Dinosaur fossils since the discovery of dinosaur tooth fossils in Pahang and several dinosaur sites on the Cicir Terengganu River in mainland Peninsular Malaysia a few years ago. A Jurassic sauropod has been also found in the Korat Plateau, North Thailand [1], about 400 kilometer away from Tanah Merah Kelantan The purpose of this paper is to introduce the discovery of Sauropod fossil in Malaysia and will be followed up in by more detailed studies related to the existence of sauropod in Malaysia.

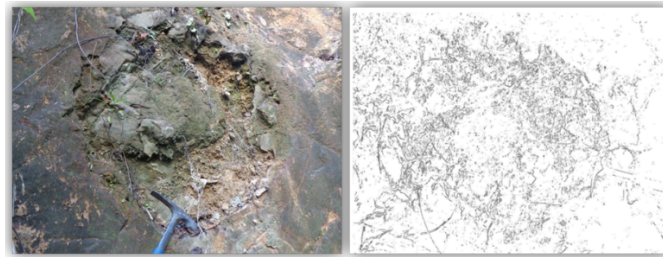




some places the granite is pink due to orthoclase dominated mineral composition. The age of the granite is probably same as Noring granite of Cretaceous [3].

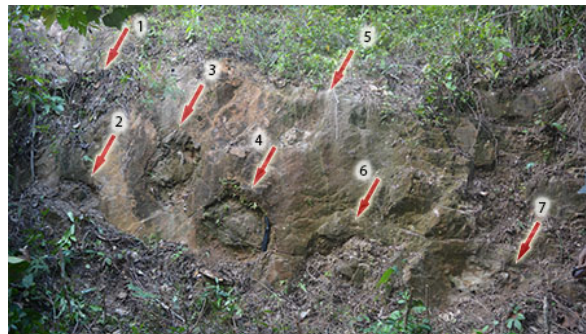
#### 4. Description

The fossils found are tracks of at least 7 footprints (track) and trackways as shown in figure 3. All tracks are found printed on top of quartz sandstone from Panau Formation, which is probably in Cretaceous period located at foot of the Bukit Panau, Tanah Merah District, Kelantan State, Malaysia. The most obvious track can be seen in figure 2 is a graviportal (weight-bearing) limbs. The metacarpal bone ends that touch the ground are very large and even though the traces show the impression of convex sediment and some specimens preserving the remaining soft tissue covering this area. This indicates that the foot is framed with a kind of padding in this species. The tracks are broad splaying out to the side to create a wide foot as in elephants and retain three claws although they are not seem clear.



**Figure 2.** The best preserved track (a) with its vectorized picture (b).

So far, pes–manus track pairs can not be distinguished from trackway. Track sites are cataloged as No.1, No.2, No.3, No.4, No.5, No.6 and No.7 (Figure3) Track No. 3, No.4, No.5 and No.6 all preserved well and until now all tracks remain in the field.



**Figure 3.** Fossil Track sites at Bukit Panau

Detail measurements of trackways shown in Figure 4. Tracks average length is 72 cm and the average width is 66 cm, The width of the sediment displacement rim is approximately 18 cm. The metacarpophalangeal region is concave. Digits I, II, and III have identifiable claw marks, digit IV has a depression made by foot callosity. Digit V is indicated by a small lateral lobe. The metatarsophalangeal pad region is smoothly curved.



**Figure 4.** Distribution and distances (cm) of tracks on trackways.

### 5. Geological Setting

The morphology and trackway configurations of the track sites and trackway of the suspect dinosaurs tracks found in the Bukit Panau is typical for Sauropod trackways [4,5] and similar to the one found in China, called Brontopodus [5]. This trackway is clearly narrow-gauge, based on the ratio of 0.9, close to 1.0. However, there are some differences in distances of their front and back foot, which possibly caused by different size of animals or of whether the animal walked or run. The track size and trackways might represent a large Sauropod with about 22 meter length, 9 high and 30 to 40 metric tons [6]. The Bukit Panau Sauropod might be comparable to the Jurassic Sauropod found in Thailand and in China.

The Sauropod tracks in the Bukit Panau were found in the quartz sandstone layer of the Panau Formation, which is cropped out about 3 x 20 meters wide. There was not an agreement between the age of the Panau Formation as well as the granite intrusive. MT-JGSC [2] suggested the age of the Panau Formation is Cretaceous and non-conformably underlying the granite. However, our preliminary investigation found that the granite possibly younger, which intruded the older Panau Formation. Most of the dinosaurs big foot, including Sauropod in Thailand [1] and in China [5], live in Jurassic. If it is true that the tracks found in Bukit Panau are Sauropod tracks of Jurassic period, then the age of the Panau Formation should be Jurassic that was intruded by Cretaceous Granite.

Based on tracks site these fossils represent an animal within the size range of large cretaceous sauropods reaching a length of 22 meter long and 9 meters high, with weight estimated 30 to 40 metric tons [6].



**Figure 5.** Sauropod.

## 6. Conclusion

Distribution pattern and morphology characteristics of the fossil tracks and trackways found at Bukit Panau indicates that the fossils belong to a Sauropod Dinosaurs, some specific characteristics could be related to genus *Apatosaurus*. Rock age dating needs to be done to ensure the age of this fossil, so far there is no definitive evidence to refer this fossil to Cretaceous-aged.

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