

NOTE ON THE CONTINENTAL DEPOSITS OF PENINSULAR THAILAND WITH A DESCRIPTION OF SOME CONCHOSTRACANS

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After making a study of conchostracan fossils taken from the half way between Trong and Krabi on the southern Thailand of Malaya Peninsula, the deposits bearing this fauna are thought to be Middle Jurassic in age. Thus, it is most probably that there are two conchostracan levels found within Thailand so far. One belongs to middle Upper Triassic by Kobayashi, and the other is ours of Middle Jurassic.

Key Words Thailand Continental deposits Biostrata

Continental deposits are not very widespread and very thick in Peninsular Thailand (Fig. 1). They have been less studied than the Khorat Group of East Thailand. Accordingly, the discovery of a new fossiliferous locality between Krabi and Trang is significant in the present state of our knowledge.

I. The Continental Deposits of Peninsular Thailand*

The age of these continental deposits had been controversial for a long time, until 1981 when for the first time, it has been documented by a study of some plants. In 1987, relatively abundant vertebrates remains have been the subject of a preliminary study. They had been collected from the same locality as the Conchostraca described below.

Stratigraphical nomenclature: Even though there was no palaeontological evidence, the continental deposits of Peninsular Thailand were correlated on a lithological basis with the continental strata widespread in Northeast Thailand (Khorat Plateau) and ranging in age from the Late Triassic to the Late Cretaceous (Brown et al 1951). However, the continental sediments of Northeast Thailand reach a thickness of 5000 m and are much more important than those of Peninsular Thailand. Because of that, this correlation raised some problems.

Despite their lithological similarity to the strata of the Khorat Group, the continental deposits of Peninsular Thailand were considered to be intercalated and interdigitated with Permian limestone by C.

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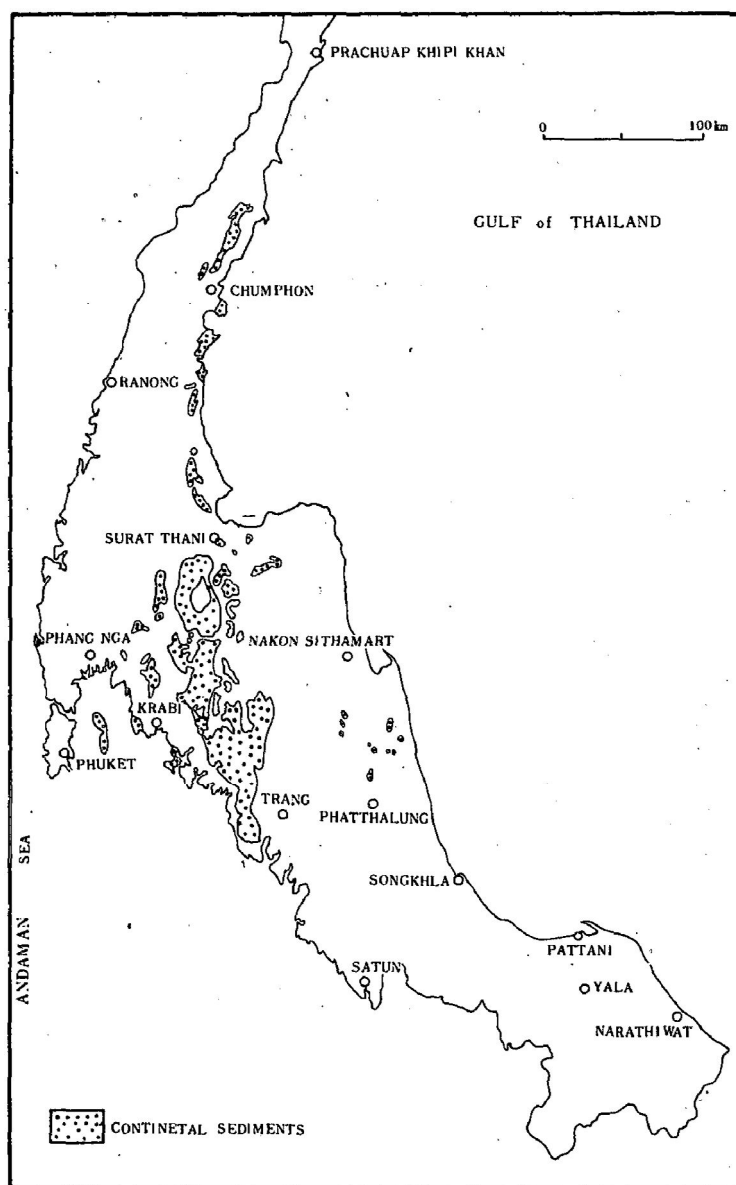


Fig. 1. The distribution of continental sediments in Peninsular Thailand

Palaeontology: Up to now in Peninsular Thailand, only six species of fossil plants have been identified and described; they had been collected from three localities of Trang area. They belong to Filicales, Bennettitales and Coniferales. They indicate an early Early Cretaceous age (Asama et al 1981). They resemble plants found in Peninsular Malaysia at Gunung Gagau (Konno 1967, 1968), near Maran (Smiley 1970), at Hulu Endau (Konno and Asama 1975, Asama 1978) and at Panti (Konno 1967). The name of "Gagau Flora" has been proposed by Konno 1967 (Fig. 2).

Apart from that flora, invertebrates have been noticed. Conchostraca, under the name of "*Estheria*", are known in Peninsular Thailand for some time already and are mentioned by Asama et al 1981. Insects are relatively abundant at Khao Noen Poon Sri (=Khao Nin Phu Sri of Buffetaut et al 1987) between Trang and Krabi; they are mainly dragonflies. Ostracods are also present at Khao

K. Burton (1978) who formalized this continental sequence under the name "Matsi Formation" and assigned it to the Permian.

In the Phuket region, Garson et al (1975) described the Mesozoic Ko Yao Formation, about 400m thick and consisting of sandstone, siltstone and conglomerate.

Mesozoic plants were discovered near Trang in 1978 (Asama et al 1981) in the continental deposits which were divided into three units;

Upper unit consisting of red beds, mainly siltstone and sandstone. This upper unit yielded the fossil plants.

Middle unit composed also of arenaceous red beds.

Lower unit consisting predominantly of argillaceous limestone and dark shale containing "*Estheria*".

Recently, Permian limestone pebbles have been found in conglomerates near Krabi (Fontaine 1987) and north of Chumphon (Fontaine and Suteethorn 1988). These discoveries confirm a Mesozoic age.

Noen Poon Sri. Before this paper, these invertebrates had not been studied. In Thailand, Conchostraca had been investigated only in Northeast Thailand (Kobayashi 1973); in that part of the country, they are older and Late Norian in age.

Remains of vertebrates found at Khao Noen Poon Sri include scutes of crocodilians, incomplete turtle plates, fish scales (*Lepidotes*) and teeth (*Enchodus*). *Lepidotes* is common in the Jurassic and still present in the Cretaceous but rare after the Cenomanian. *Enchodus* has not been reported before the Cretaceous. Accordingly, the fish remains have suggested an Early Cretaceous age in their preliminary study (Buffetaut et al 1987).

New fossiliferous locality: At Ban Kuan Kun, village located 65km far from Trang or almost halfway between Trang and Krabi (Fig. 3), shale and mudstone, gray to black, crop out near a small road in a narrow exposure. They plunge below thick sandstone and conglomerate forming a hill to the north, hill called Khao Noen Poon Sri.

Although the exposure displays only about three meters of sediments, it has provided abundant fossils which are not regularly distributed, but are concentrated in a few thin horizons. These fossils include: poorly preserved fragments of plants (these plants appear to be not diverse), conchostracans (studied below), ostracods, insects (mainly dragonflies), scutes of crocodilians, incomplete turtle plates, fish scales and teeth (Among them, scales of *Lepidotes* and teeth of *Enchodus* have been identified).

Conclusion: The main palaeontological results obtained to date are fitting together; the plants from the upper unit indicated an early Early Cretaceous age (Asama et al 1981) whereas the conchostracans of the lower unit suggest a late Middle Jurassic age (See below). A more detailed study of the vertebrates will probably bring new data in the future.

In Northwest Thailand (Mae Sot area) where marine Jurassic is well developed, the late Middle Jurassic is unknown; it may correspond to a stratigraphical hiatus or to a very slow sedimentation forming thin beds difficult to observe (Fontaine and Suteethorn 1988).

A conglomerate known from Mae Sot to Kanchanaburi contains Jurassic limestone pebbles; consequently it is post - Jurassic and probably Cretaceous in age. The continental deposits of Peninsular

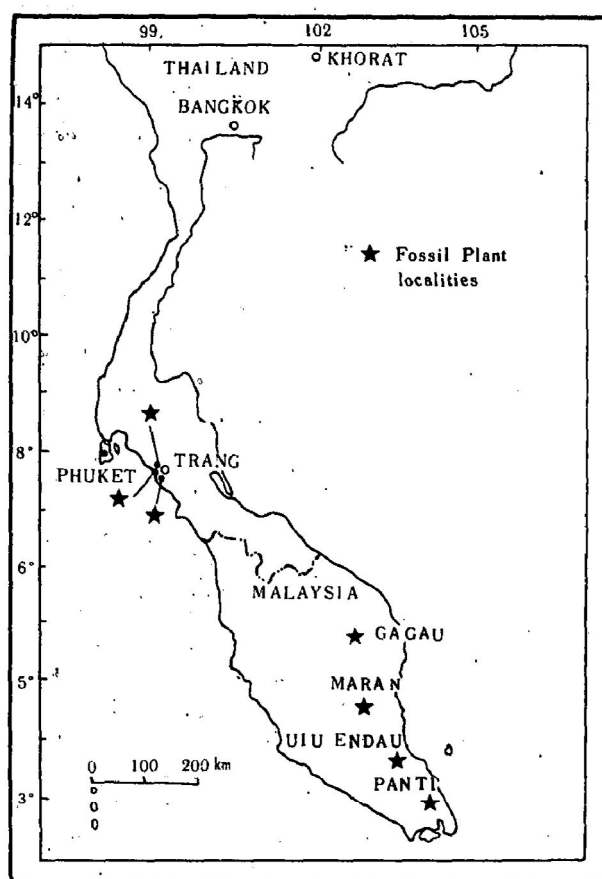


Fig. 2. Map showing plant localities with the Gagau Flora in Thailand and Malaysia.

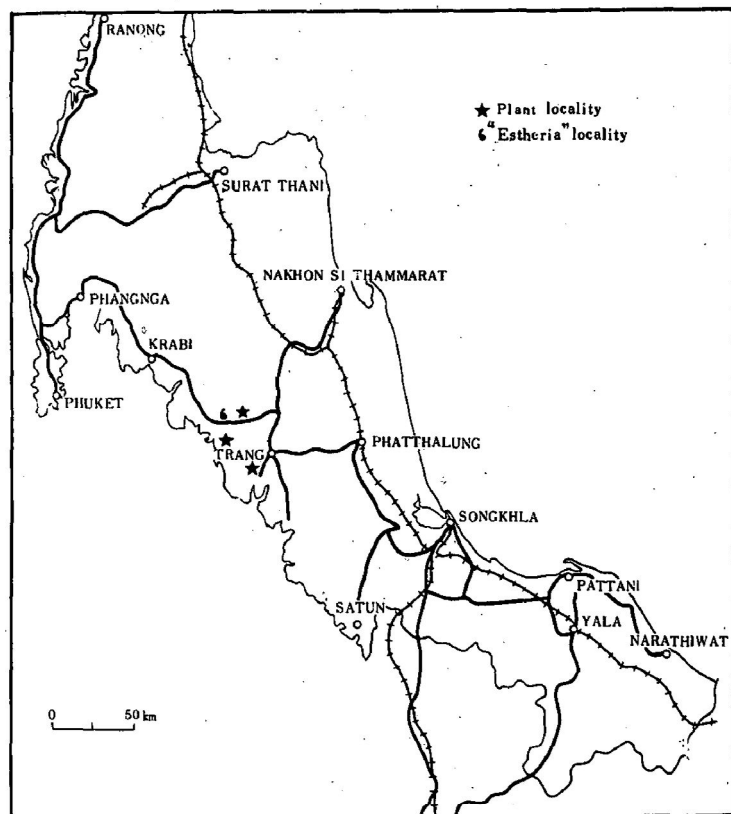


Fig. 3. Map showing fossil localities in Trang area.

Thailand could have been a prolongation of this conglomerate; the palaeontological results deny such an hypothesis.

II. Middle Jurassic Conchostraca From Peninsular Thailand*

The present fossil conchostracans observed were collected from an outcrop at halfway between Trang and Krabi in the peninsular part of Thailand. Sampling number in field is T2284. The lithology bearing abundant and better preserved conchostracan fossils is light yellow shale and calcareous dark gray mud-

stone, which are associated with crocodile teeth, fish teeth and scales as well as insects etc. By means of LM and SEM study, This conchostracan fauna, 3 genera and 6 species have been recognized initially at least. The assemblage demonstrated strong colour of Middle Jurassic in age and consists of following members:

- Pseudograptia* cf. *yuzhongensis* Chen
- Pseudograptia* *jialingensis* Duan
- Pseudograptia* *siamensis* (sp. nov)
- Pseudograptia* sp.
- Paleoleptestheria* *chinensis* Chen
- Palaeolimnadia*? sp.

According to Prof. Chen et al, Middle Jurassic fossil conchostracans in China can be divided into *Euestheria ziliujingensis* group in its lower part and *Pseudograptia* group in its upper part. The latter is composed of species which mainly belong to the genera *Pseudograptia*, *Paleoleptestheria* and *Nestoria*. The conchostracan fossils examined from Peninsular Thailand are essentially assigned to genus *Pseudograptia*, which is characterized with irregular large reticulate sculpture in most growth bands of the carapace and radial lirae arranged closely toward the ventral margin and posterior margin. The relationship between reticulate and radial lirae is sudden change. *Pseudograptia yuzhongensis* and *P. jialingensis* have been

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seen respectively in Tieyegou Formation of Yuzhong County in Gansu Province and in the B member of Guangyuan Group in Guangyuan County of Sichuan Province. Both species are late period of Middle Jurassic in age. The *Pseudograptia siamensis* is more common in sample obtained from the studied locality. Though a species nova, the *Pseudograptia siamensis* could be compared with the genotype *P. marchisonia* (Jones) originally discovered in England or similar genera found in China in sculpture characteristics.

The specimens designated to *Paleoleptestheria chinensis* Chen in Peninsular Thailand are less frequent. The species has been reported to occur in Upper Shaqimiao member of Chongqing Group in Guizhou Province and B member of Guangyuan Group in Sichuan Province, both which represented the geological horizon of upper part of Middle Jurassic in Southwest China. *P. chinensis* found in Peninsular Thailand is closely similar to that one determined in Halahe of Weining County, Guizhou Province, with an age of late Middle Jurassic.

So far as known the upper part of Zhanghe Formation in Dayao County is the only horizon that yields upper Middle Jurassic fossil Conchostraca in Yunnan Province. Two species of genus *Nestoria* were reported from this level. Though the data in the Zhanghe Formation are limited, the conchostracan beds could approximately be correlated with that being discussed in the paper from southern Thailand.

To sum up, the sediments bearing fossil conchostracans at the halfway between Trang and Krabi in the Peninsular Thailand are of late Middle Jurassic in age.

Conchostracan fauna from the basal part of the Khorat Group at Nam Phrom Dam in Northeast Thailand has been described and discussed by Prof. Kobayashi (1973, 1975, 1984). On the basis of occurrence of *Euestheria mansuyi*, a typical species of Noric age, and Late Triassic land plants existing in middle part of Upper Huai Hin Lat Formation which is thought to be equivalent to *Euestheria mansuyi* horizon at Nam Phrom Dam, Kobayashi determined the conchostracan beds called Nam Pha Formation, a local basal unit of Khorat Group, to be Late Triassic in age. Unfortunately, Kobayashi's paper did not enter into details of the sculpture. Therefore, it is extremely difficult to make exactly correlation between the two conchostracan faunas in Thailand. According to Kobayashi (1984), the Khorat Group of Khorat Plateau in Central-East Thailand can be divided into three subgroups and seven formations as follow:

Khorat Group		Lithofacies
Subgroup	Formation	
Upper	Lom Sak	Limnic
	Khok Kraut	
	Phu Phan	
Lower	(Sao Khua)	Paralic
	Pha Wiham	
	Phu Kradung	
Basal	Nam Phong	Limnic
	Huai Hin Lat	

The geological age of three subgroups is respectively Late Triassic, Jurassic and Cretaceous in ascending order. The Lower Khorat Group includes Phu Kradung Formation consisted of red beds with 1000 meters thick and Phra Wihan (Sao Khua) Formation dominated with sandstone and conglomerate attaining 500 to 700 meters in thickness. Marine bivalves like *Cardinoides magnus*, *Mytilus* sp. and *Goniomya*? sp. were found in the Sao Khua Formation in certain places. It seems very likely that the geological age of Sao Khua or Phra Wihan Formation is not older than Early Jurassic. One of the Jurassic bivalve *Neomiodon* sp. was encountered in sediments equivalent to the Phra Wihan Formation near Chumphon in the Peninsular Thailand, where borders the conchostracan locality studied in this paper on the northeast. Therefore Kobayashi has proposed that the limnic-paralic-limnic Khorat Group might extend from the middle part of Yunnan, passing through the Khorat Plateau, onto the peninsular part of South Thailand. On the ground of what mentioned above, the conchostracan horizon at the halfway between Trang and Krabi should be equivalent to at least the upper part of Sao Khua Formation of Khorat Plateau in central East Thailand. Furthermore, it is presumed that the conchostracan beds of the basal Khorat Group at Nam Phrom Dam in Northeast Thailand, as reported by Kobayashi, is lower in the sequence than the present paper's. That means there are at least two horizons bearing fossil Conchostraca in Thailand so far, one of which is the middle part of Upper Triassic and the other occurs in the upper part of Middle Jurassic.

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REFERENCES

- [1] Asama K., Nakornsri N., Hinthong C. and Sinsakul S., 1981 Geol. Palaeont. Southeast Asia, Vol. 22, P. 35—47, Pl. 11.
- [2] Asama K., 1978, Geol. Palaeont. Southeast Asia, Vol. 19, P. 49—56, Pl. 6.
- [3] Brown G. F., Buravas S., Charaljavanaphet J., Jalichandra N., Johnson W. D., Srethaputra V. and Taylor G. C., 1951, Bull. U. S. Geol. Surv., Vol. 984, P. 183.
- [4] Buffetaut E., Martin M., Suteethorn V. and Udonratn C., 1987 Terra Cognita, Vol. 7, No. 2—3, P. 349.
- [5] Burton K., 1978, Proc. 3d Reg. Conf. Geol. Min. Res. Southeast Asia, P. 33—41.
- [6] Fontaine H., 1987, CCOP Newsletter, Vol. 12, No. 1, P. 25.
- [7] Fontaine H. and Suteethorn V., 1988, CCOP Techn. Bull., Vol. 20.
- [8] Garson M. S., Young B., Mitchell A. H. G. and Tait B. A. R., 1975, Inst. Geol. Sc. Overseas Mem., No. 1, P. 112.
- [9] Konno E., 1967, Geol. Palaeont. Southeast Asia, Vol. 3, P. 135—164, Pl. 25—27.
- [10] Konno E., 1968, Geol. Palaeont. Southeast Asia, Vol. 4, P. 139—155, Pl. 24—27.
- [11] Konno E. and Asama K., 1975, Geol. Palaeont. Southeast Asia, Vol. 16, P. 91—102, Pl. 8—11.
- [12] Smiley C. S., 1970, Bull. Geol. Soc. Malaysia, No. 3, P. 77—112, Pl. 1—5.
- [13] Chen Piji, 1976, Mesozoic fossil of Yunnan, Vol. 2. P. 331—372, Scientific Publishing House, Beijing (in Chinese).
- [14] ——— and Shen Yanbin, 1979, Mesozoic and Cenozoic Red Beds of South China, P. 79—110, Scientific Publishing House, Beijing (in Chinese).
- [15] Duan Weiwu, 1978, Atlas of fossils of Southwest China (Sichuan volume), part I, P. 448—460, Geological Publishing House, Beijing (in Chinese).
- [16] Kobayashi, T., 1954, Jour. Fac. Sci., Univ. Tokyo, Sec. 2, Vol. 9, P. 1—192.

- [17] —, 1973, Proc. Japan Acad., Vol. 49, No. 10, P. 825—828.
[18] —, 1975, Geol. Palaeont. Southeast Asia, Vol. 16, P. 57—90.
[19] —, 1984a, Geol. Palaeont. Southeast Asia Vol. 25, P. 3—42.
[20] —, 1984a, Ibid, P. 283—288.
[21] Zhong Wentang, Chen Piji and Shen Yanbin, 1976, Fossil Conchostraca of China, Scientific Publishing House, Beijing.

EXPLANATION OF PLATE

Plate I

- 1—3. *Pseudograptia* cf. *yuzhongensis* Chen
1. External mold of two valves, 8×, cat. no. 8710-1.
2. Sculpture near the ventral margin of specimen 8710-1, SEM, 40×.
3. Sculpture near the anterior ventral margin of the specimen, SEM, 40×.
4a. *Pseudograptia jialingensis* Duan
Internal mold of left valve, 8×, cat. no. 8709-3.
4b, 5. *Pseudograptia* sp.
4b. Internal mold of right valve, 8×, cat. no. 8709-3;
5. Right valve, 8×.
6—8. *Palaeolimnadia*? sp.
6. Left valve, 10×, cat. no. 8707-2;
7. Same specimen as no. 6, 20×;
8. A broken left valve, 20×, cat. no. 8707-3.
9—11. *Paleoleptestheria chinensis* Chen
9. Right valve, 10×, cat. no. 8712.
10. Sculpture near the ventral margin of the specimen 8712.
11. Sculpture of another specimen.

Plate II

- 1—6. *Pseudograptia siamensis* (sp. nov.)
1. Holotype, left valve, 8× cat. no. 8710-2;
2. Sculpture near the ventral margin of the specimen 8710-2; SEM, 40×.
3. Sculpture at the middle part of valve in specimen 8710-2.
4. A broken right valve, 12.5×, cat. no. 8709-1.
5. Sculpture at the ventral part of the specimen 8709-1, SEM, 40×.
6. Sculpture at the ventral part of the specimen 8709-1, 40×.