

PERMIAN LIMESTONE OF PENINSULAR AND WESTERN THAILAND IN KHAO YOI, CHA-AM AND THONG PHA PHUM AREAS

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ABSTRACT

A paleontological study was carried out on limestone samples collected during field work in March of 2011 in two areas in northern Peninsular Thailand (Khao Yoi and Cha-am areas in Petchaburi Province) and single area in western Thailand (Thong Pha Phum in Kanchanaburi Province). Limestone at Khao I-bit (Khao Yoi area) was rich in fusulines, indicating an Upper Murgabian (Middle Permian) age. At Khao Nang Phanthurat and Khao Tachin (Cha-am District), corals and fusuline fossils in limestone belong to Middle Permian. In Thong Pha Phum area near Khao Laem Dam (Thong Pha Phum District), fossils similar to those of Khao Yoi and Cha-am areas were found, and a few thin sections suggested a Shan-Thai fauna. The present study suggests that Middle Permian limestones of Peninsular and western Thailand yield similar faunas which are typical of the Shan-Thai (Sibumasu) Block.

Key words: Peninsular Thailand, Permian limestone, corals, foraminifers, Shan-Thai Block

INTRODUCTION

In Khao Yoi, Cha-am and Thong Pha Phum areas (named after districts which they belong to), Peninsular and Western Thailand, limestone builds up important hills with a beautiful karstic topography. Samples in this study were collected from some of these hills from 2 to 22 March 2011. They contain fossils (fusulines and corals) which are common in the Shan–Thai (or Sibumasu) Block. These faunas are referable to a part of the Middle Permian, mainly to the Murgabian. However, there are minor differences in age in these localities, ranging at least from the early to late Murgabian. Growth bands, which were reported in corals from another Permian locality of Peninsular Thailand (FONTAINE & JUNGYUSUK, 1997), are absent in the corals studied here, probably because the paleoclimate started to become warmer only during the younger part of the Middle Permian. Materials studied here have been deposited in Palaeontological Research and Education Centre, Mahasarakham University, Thailand.

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RESULTS

Khao Yoi Area

(Figs. 1 and 2)

In a quarry at Khao I-bit ($13^{\circ}18'13.89''$ N, $99^{\circ}46'10.57''$ E; samples T11136 to T11138; Fig. 2A–F), a limestone hill in Khao Yoi District north of Phetchaburi, fusulines are locally in great abundance. They are remarkable because of their size. They are not large in diameter (up to 3 mm) but are commonly more than 10 mm in length. Samples collected in this locality are packstone and very rich in *Eopolydiexodina megasphaerica* Leven, 1967, a species which indicates a Late Murgabian (Middle Permian) age. This species had already been mentioned in the northern part of Peninsular Thailand in the Kanchanaburi area south of Ban Phu Plu where it is locally common (FONTAINE & SUTEETHORN, 1988, p. 36). *Eopolydiexodina* is a typical element of the Permian limestone of Peninsular Thailand (UENO *ET AL.*, 1996; UENO, 2003). In the Phetchaburi area, another foraminifer (*Shanita*) is characteristic of the Shan–Thai Block; it is common in the limestone of Khao Tham Mo, southwest of Phetchaburi (FONTAINE & SUTEETHORN, 1988, pl. 5, Figs. 1–8). In Peninsular Thailand, *Shanita* was first described by BRONNIMANN *ET AL.* (1978) in the Phangnga area.

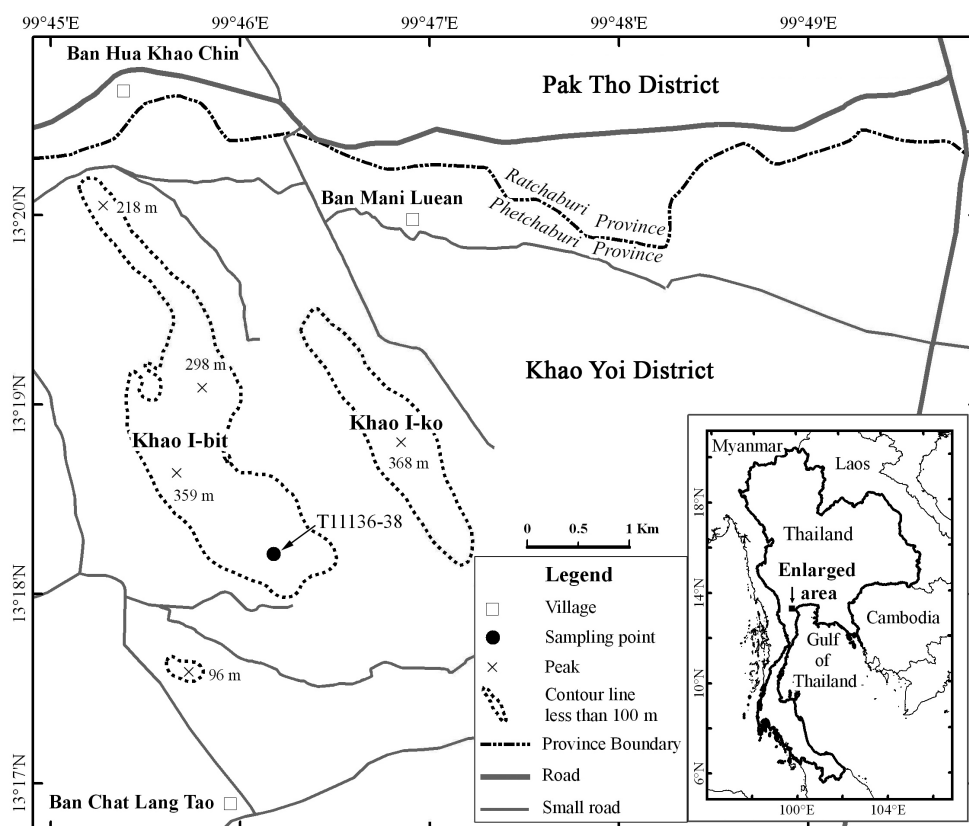


Figure 1. Khao Yoi area in Khao Yoi District, Phetchaburi Province, Thailand.

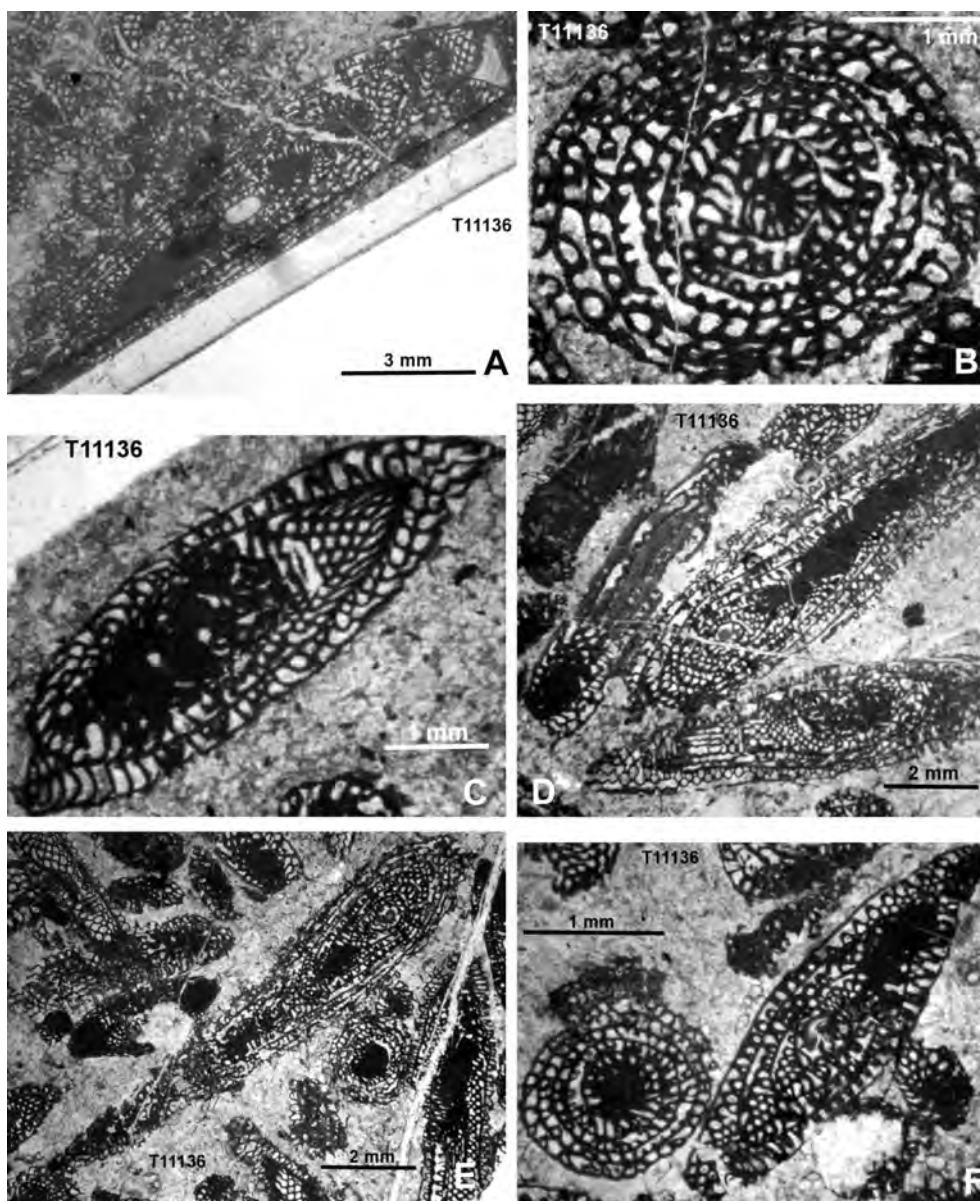


Figure 2. Upper Murgabian fossil, *Eopolydiexodina megasphaerica* Leven, 1967 (sample T11136), from Khao I-bit, Khao Yoi District: A, typical axial section showing the large proloculus; B, subtransverse section; C, tangential section showing the axial filling (left) and the numerous aligned cuniculi (right); D, several subaxial sections; E, numerous subaxial, oblique and subtransverse sections; F, subtransverse section (bottom, left) with a subaxial section (right) showing a relatively rhomboidal profile of the test and the intensity of septal folding, and both the axial filling.

Cha-am Area (Figs. 3, 4 and 5)

In the Cha-am area, Cha-am District, Phetchaburi Province, we studied limestone samples collected from two hills, Khao Nang Phanthurat and Khao Tachin. Khao Nang Phanthurat is a long hill built up by a grey thickly bedded limestone without chert nodules. We have investigated two localities in this hill. Fossils are scattered and display corals consisting of fasciculate Tabulata, a few solitary Rugosa and more common massive Rugosa. At the first locality (12°50'18.1" N, 99°57'12.3" E; sample T10996; Fig. 4A and B), a massive Rugosa reaches up to 20 cm in diameter. In transverse section, corallites are prismatic and 8–12 mm in diameter. Their wall is thin and slightly discontinuous. Septa are of two orders and about 24+24 in number. Minor septa are almost as long as the major septa. All the septa are commonly thicker in the tabularium than at the periphery of the corallite. Columella is up to 2 mm in diameter. In longitudinal section, dissepiments are arranged in up to 6 rows. Tabulae are a little less than 20 in a vertical distance of 1 cm. Columella is made of strongly arched tabellae which are more than 30 in a vertical distance of 1 cm. It displays a thin median plate. The corallites of this coral display a diameter a little larger than the corallites of *Paraipicphyllum kulvanichi*

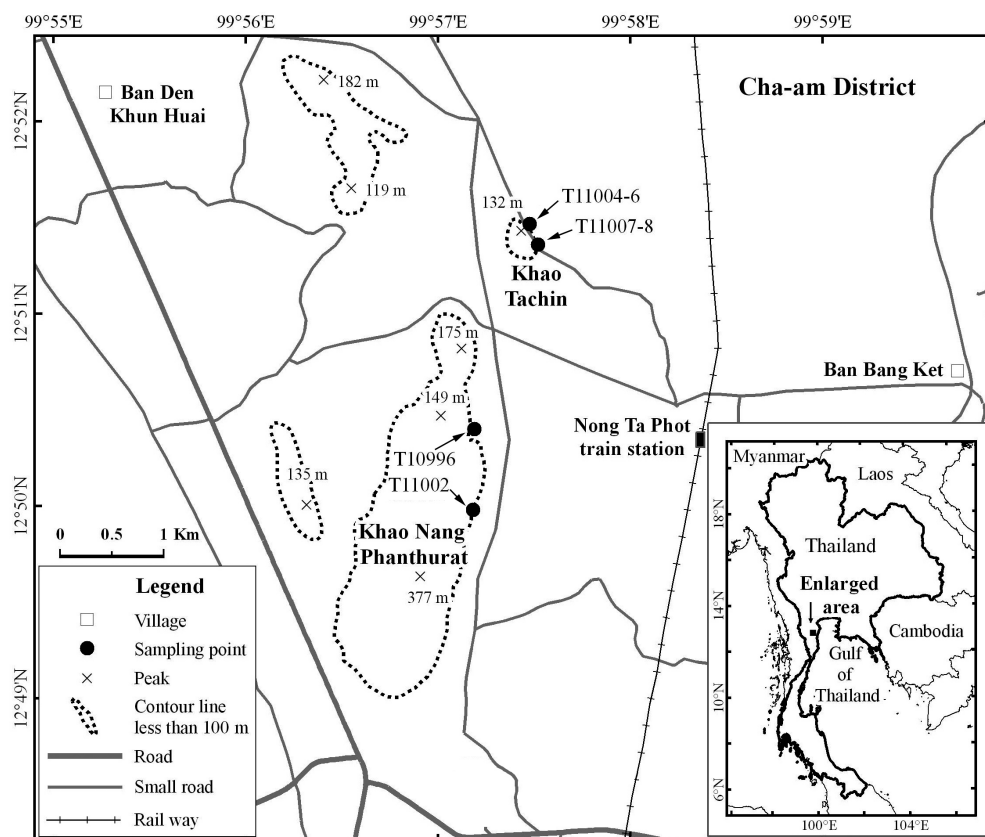


Figure 3. Cha-am area in Cha-am District, Phetchaburi Province, Thailand.

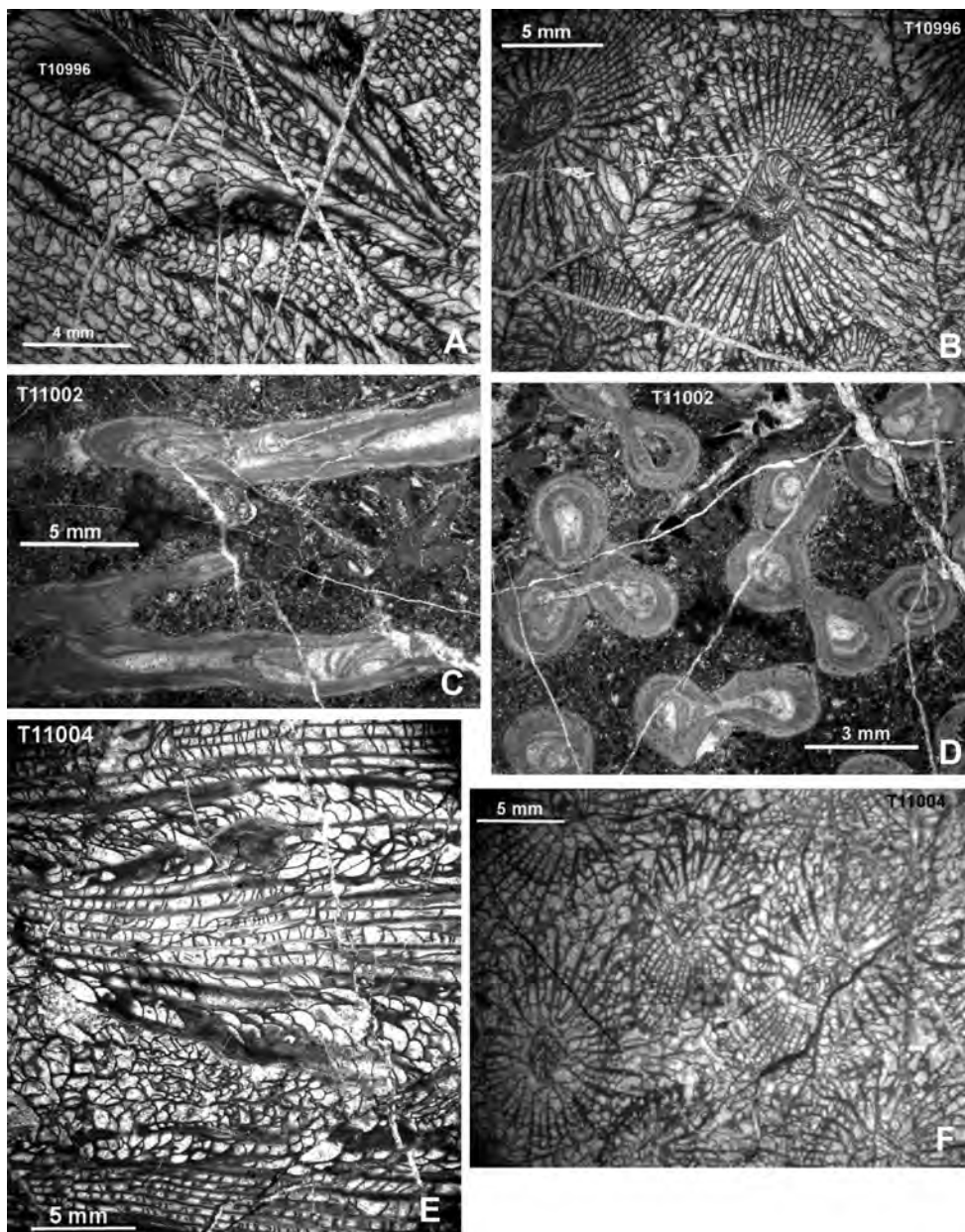


Figure 4. Middle Permian(upper part) fossils from Khao Nang Phanthurat, Cha-am District: A, *Paraipciphyllum kulvanichi* Fontaine, Longitudinal section, sample T10996; B, *Paraipciphyllum kulvanichi* Fontaine, transverse section, sample T10996; C, *Sinopora asiatica* Mansuy, longitudinal section, sample T11002; D, *Sinopora asiatica* Mansuy, transverse section, sample T11002. Middle Permian fossils from Khao Tachin, Cha-am District: E, *Paraipciphyllum thailandicum* Fontaine, longitudinal section. sample T11004; F, *Paraipciphyllum thailandicum* Fontaine, transverse section, sample T11004.

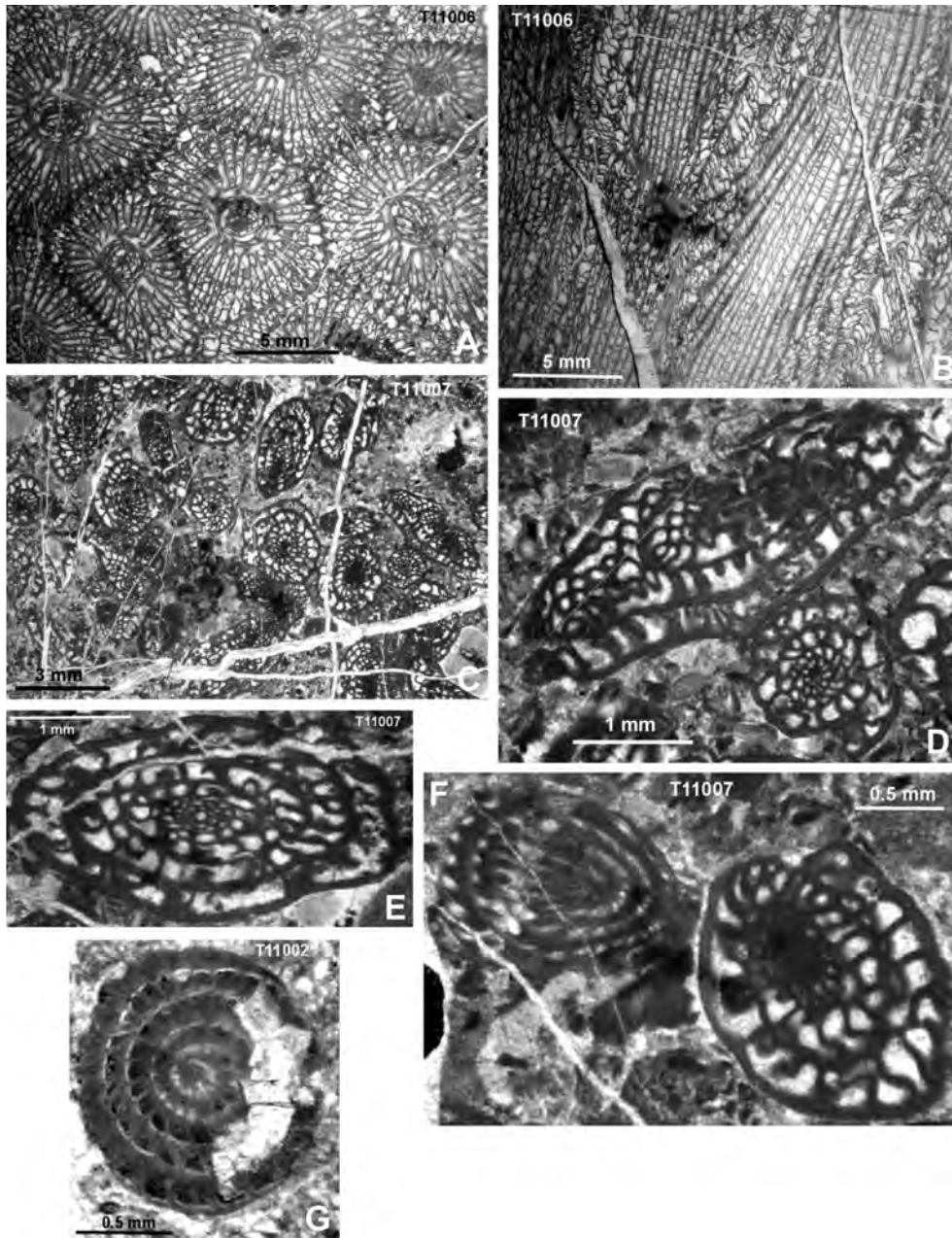


Figure 5. Middle Permian fossils from Khao Tachin, Cha-am District: A, *Paraipciophyllum kulvanichi* Fontaine, Transverse section, sample T11006; B, *Paraipciophyllum kulvanichi* Fontaine, Longitudinal section, sample T11006; C, D and E, *Parafusulina* sp., Diverse sections, Sample T11007. F, *Yangchienia iniqua* Lee, 1933 (upper part of the photograph to the left), *Parafusulina* sp. (to the right), sample T11007. Middle Permian fossils from Khao Nang Phanthurat, Cha-am District: G, *Yangchienia iniqua* Lee, 1933, Transverse section, sample T11002.

described by FONTAINE & SUTEETHORN (1988, p. 118–119, pl. 13, Figs. 1–2) and collected from Khao Tham Sua southwest of Phetchaburi, but the coral of Khao Nang Phanthurat can be considered as belonging to this species because it differs only in the slightly larger size of its corallites. The genus *Paraiphiphyllum* had already been reported in Peninsular Thailand from Khao Tham Sua by FONTAINE (1986, pl. 21, Figs. 1–3). Khao Tham Sua is a hill located near another limestone hill called Khao Tha Mo and *Shanita* was found there (FONTAINE, 1986). At the second locality (12°49'50.3" N, 99°57'07.8" E; sample T11002; Fig. 4C and D; Fig. 5E), we discovered a fasciculate Tabulata which attains almost 30 cm in diameter and is 10 cm high. It was associated with small fragments of other fossils: a few algae, rare smaller foraminifers and a fusuline. Its corallites are 2 mm in diameter (Fig. 4C and D). Their wall is thick. Tabulae are few and irregularly distributed. This coral belongs to *Sinopora asiatica* Mansuy, 1913 which has already been found at several Middle Permian localities of Peninsular Thailand (FONTAINE & SUTEETHORN 1988, 112–113, pl. 10, Fig. 5; pl. 11, Fig. 1; pl. 13, Figs. 5–6). The fusuline is *Yangchienia iniqua* Lee, 1933 (Fig. 5E) indicating a Murgabian age.

Khao Tachin is a hill north of Khao Nang Phanthurat and consists of the same type of thickly bedded grey limestone without chert nodules. We have investigated two localities also in this hill. At the first locality (12°51'26.0" N, 99°57'28.2" E; samples T11004 and T11006), we collected large massive Rugosa. They do not belong to only a single species. In sample T11004 (Fig. 4E and F), corallites are almost without walls. Parts of the septa disappear at the periphery of the corallites. Dissepiments are well developed. This sample belongs to *Paraiphiphyllum thailandicum*, a species described by FONTAINE & SUTEETHORN (1988) (p. 118, pl. 10, Figs. 3–4; pl. 11, Fig. 2; pl. 12, Figs. 1–2; pl. 15, Figs. 1–4) and was found at two limestone hills (Khao Khlong Warn and Khao Khan Ban Dai) of the Prachuab Khiri Khan area, about 60 km south of Phetchaburi. Sample T11006 (Fig. 5A and B) contains a different species of Rugosa. Its septa are more continuous and the walls of the corallites are less discontinuous. This specimen belongs to *Paraiphiphyllum kulvanichi*, a species described by FONTAINE & SUTEETHORN (1988) (p. 118, pl. 13, Figs. 1–2) at Khao Tham Sua southwest of Phetchaburi and found again at Khao Nang Phanthurat (see the previous part of this text). At the second locality near a cave (12°51'20.5" N, 99°57'30.0" E; samples T11007 and T11008), limestone is locally very rich in fusulines (sample T11007; Fig. 5C, D, E and F) and contains also fasciculate Tabulata (sample T11008). The corallites of this Tabulata are 2 mm in diameter and display thick walls. This coral is similar to that found in sample T11002 from Khao Nang Phanthurat and identified as *Sinopora asiatica*. The fusulines belong to two species; one species (*Yangchienia iniqua* Lee, 1933; pl. 3, Fig. 3F) is rare while the other belonging to *Parafusulina* (Fig. 5C, D, E and F) is abundant in this locality. This *Parafusulina* displays primitive characters: a small size and few cuniculi.

Thong Pha Phum Area

(Fig. 6)

In the Thong Pha Phum area, Thong Pha Phum District, Kanchanaburi Province, fossils similar to those of the Khao Yoi and Cha-am areas have been found. Near Khao Laem (Vajiralongkorn) Dam at Khao Nam Chon (a hill reaching up to 704 m a.s.l.), samples T10877 to T10890 were collected: samples T10877 to T10882 from the first locality (14°47'38.5" N, 98°33'44.5" E) and samples T10883 to T10890 from the second locality (14°47'52.9" N, 98°33'31.2" E). Thin sections from only three samples have been obtained up to now; they

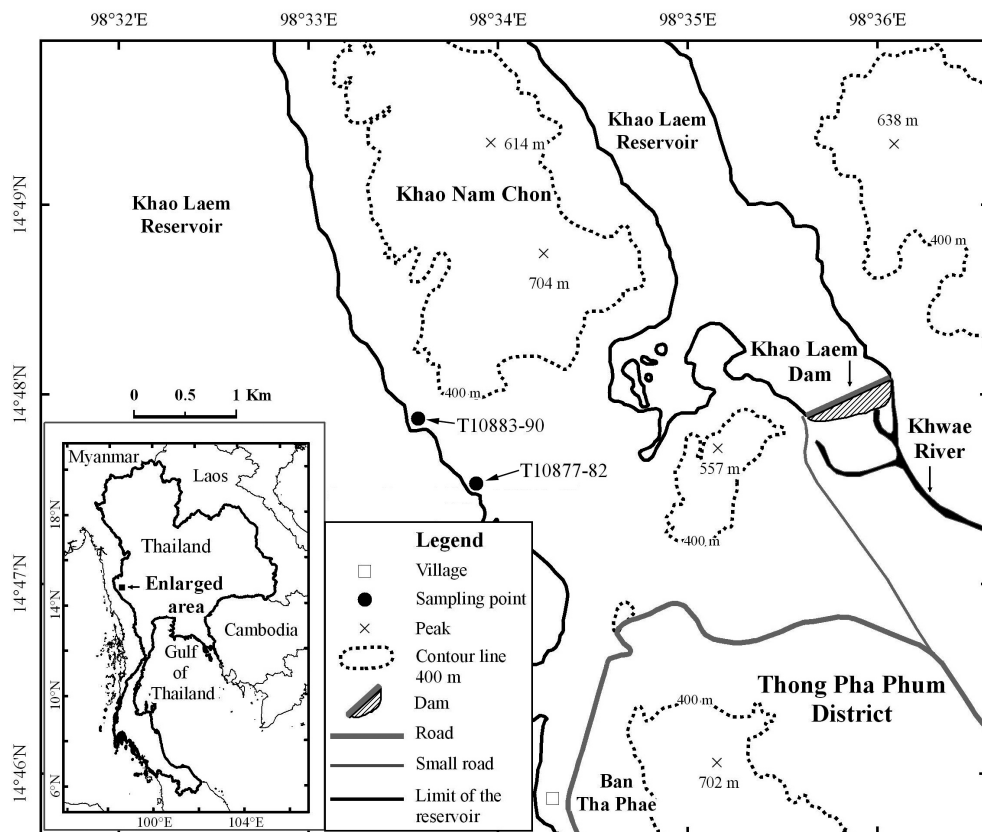


Figure 6. Thong Pha Phum area in Thong Pha Phum District, Kanchanaburi Province, Thailand.

suggest a Shan–Thai fauna with *Sinopora asiatica* (samples T10882 and T10887) and a solitary Rugosa (sample T10885) which appears to be similar to a species of *Pavastehphyllum* described by UENO *ET AL.*, 1996 in the Phatthalung area. This result suggests again that the Shan–Thai Block extends far to the north of Phetchaburi; for previous study of West Thailand, see FONTAINE & SUTEETHORN (1988).

CONCLUSIONS

During the last twenty years, it has been shown that the Permian fossils of Peninsular Thailand display clear differences from those of the Indochina Block; for instance see BRONNIMANN *ET AL.* (1978) and FONTAINE & SUTEETHORN (1988). This fact has become increasingly evident. The present study shows again that Middle Permian limestones of Peninsular and western Thailand yield similar faunas at many localities, faunas which are typical

of the Shan–Thai (Sibumasu) Block. For instance, the coral *Paraipicphyllum thailandicum* has been found at several localities starting near Khao Pang It, a hill 9 km northwest of Phatthalung (UENO *ET AL.*, 1996) in the southern-most part of Peninsular Thailand.

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