

## CHAPTER III

### RESULTS

#### 3.1 Stratigraphy

The study area is situated in two districts: Mae Sot District and Phop Phra District, Tak Province on the northwestern part of Thailand which located in the Shan-Thai Block (Bunopas, 1981). Geological map of the Mae Sot and Phop Phra areas including rock units is shown in Figures 3.1. The description of those rocks is from the report submitted to the project entitled "The evolution of Mesozoic biodiversity in Thailand" of Bureau of Geological Survey Department of Mineral Resources (Meesook et al., 2005).

Sedimentary rocks ranging in age from the Carboniferous-Permian to Quaternary predominantly have been investigated in the study area. The oldest rocks mainly consist of gray to dark gray sandstone interbedded with mudstone, siltstone and limestone of the Kaeng Krachan Group. This group was distributed in the eastern part of the area. The fossil assemblages are coral, brachiopod, and bryozoa of Upper Carboniferous-Lower Permian age. The central part is mainly composed of thick-bedded and massive dolomites and limestones known as the Ratburi Group. The fossil assemblages are predominantly of coral, bivalve, brachiopod, bryozoa and foraminifera of Permian age. The Mesozoic rocks include the Mae Sariang Group (Tr1 and Tr2). The lower unit (Tr1) consists of sandstone, interbedded with gray shale. The upper unit (Tr2) consists of shale intercalated with sandstone, limestone and chert with abundant bivalves and foraminifera. Marine Jurassic rocks in these areas are generally underlain unconformably by Triassic and overlain by Quaternary strata. New lithostratigraphic units are established: Khun Huai, Doi Yot, and Pha De Formations of the Hua Fai Group in the Mae Sot area. Tertiary rocks are composed of semi-consolidated conglomerate, mudstone, sandstone and limestone conformably underlain by the Mesozoic rocks. The main structural features of the Mae Sot-Phop Phra areas are synforms with plunging to the NW direction.

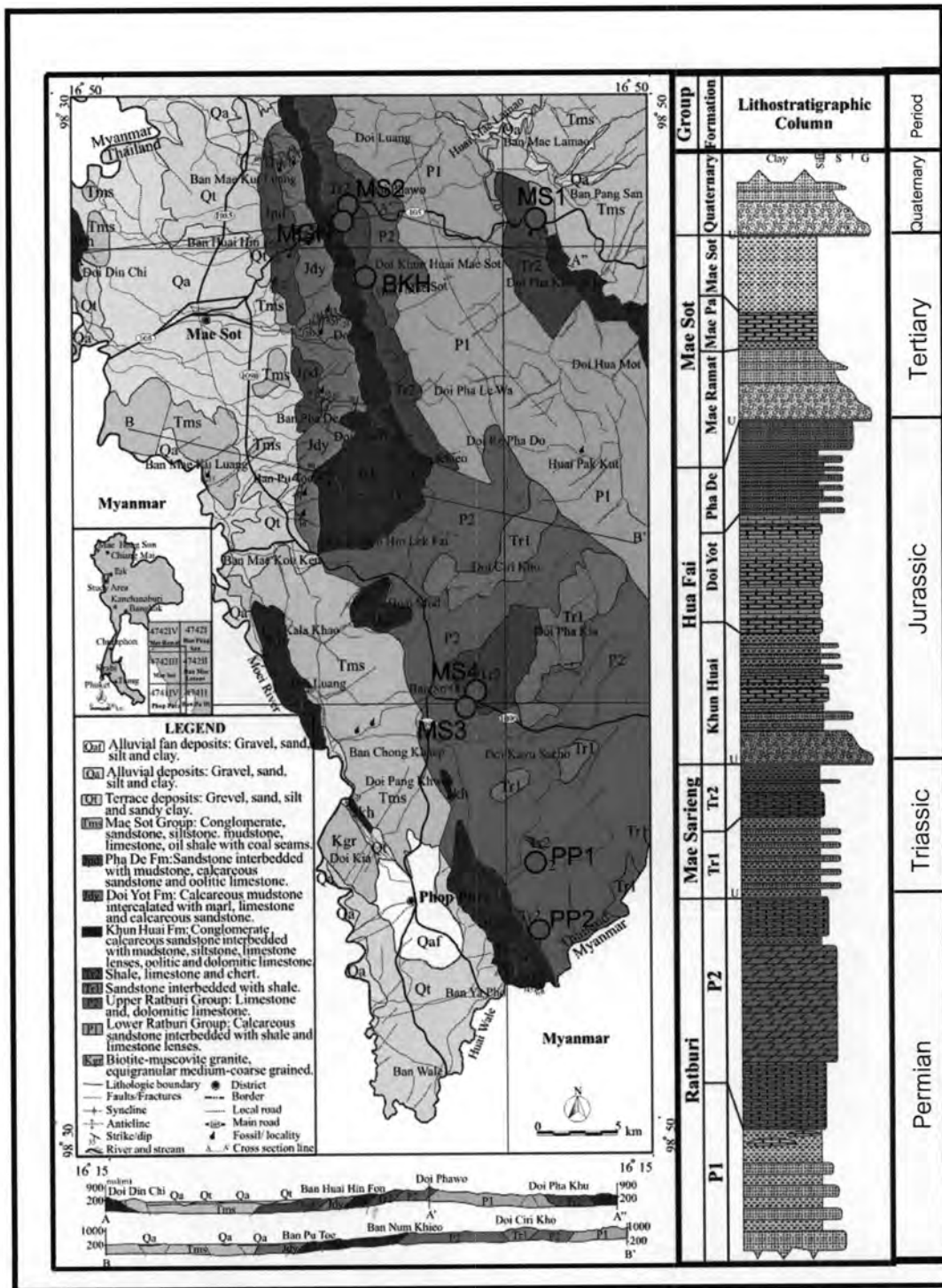


Figure 3.1 Geologic map showing the investigated areas and the distribution of the Triassic rocks in Mae Sot and Phop Phra Districts, Tak Province, Scale 1:50,000 (after Saengsrichan, 2006 unpublished data).

Eight sections are measured in the study area in order to study their stratigraphy and paleontology. Sections in Amphoe Mae Sot (section MS1, section MS2, section MGH and section BKH), and section in Amphoe Phop Phra (section MS3, section MS4, section PP1 and section PP2) have been investigated.

### 3.1.1 Section MS1 (UTM 475958 E, 1853149 N)

Section MS1 is located along the highway no. 105, km 50 along the highway from Tak to Mae Sot (Figure 3.2 and 3.3). The attitude of bedding is  $140^{\circ}/25^{\circ}$  SW. The thickness of section is approximately 21 m. Forty one rock samples were collected. The carbonate sample was collected every 50 cm through the section. The strata consist of mostly of light gray, dark gray and reddish gray limestones and muddy limestones intercalated with thin black shale about 5-20 cm in middle part of the section. The thickness of individual layers is generally about 10-20 cm. Microscopically, the limestone consists of thin-shell bivalves and radiolarias (Figure 3.11). Radiolarian fauna contains *Capnuchosphaera* sp. which is the characteristic fauna of Carnian to Norian. Moreover, calcareous shale found in the strata also contains the bivalve *Halobia* sp. which is an index fauna of Upper Triassic. Based on the occurrence of radiolarian fauna and *Halobia* sp., the age of this section is considered as Carnian to Norian (Late Triassic).

### 3.1.2 Section MS2 (UTM 463394 E, 1854470 N)

Section MS2 is located along the highway no. 105, km 66+800 from Tak to Mae Sot (Figure 3.3). The attitude of bedding is bedding  $175^{\circ}/40^{\circ}$ W. The thickness of section is approximately 380 m. The strata consist of coarse- to fine-grained, thin to thick-bedded sandstone and mudstone. Sandstone is gray showing fining upward sequence, and lamination. Ripped-up mud clasts are common in the basal beds. The sequence of turbidite sandstone, interbedded mudstones have been observed. The thickness of sandstone beds decrease to the top. The thickness is varied from 10-30 cm to 1 m in the lower part and 5-10 cm in the upper part of the sequence. Mudstone is gray and thin

bed. The ratio of the sandstone to mudstone is 2:1 in the lower part and 1:1 in the upper part of the section (Figure 3.4).

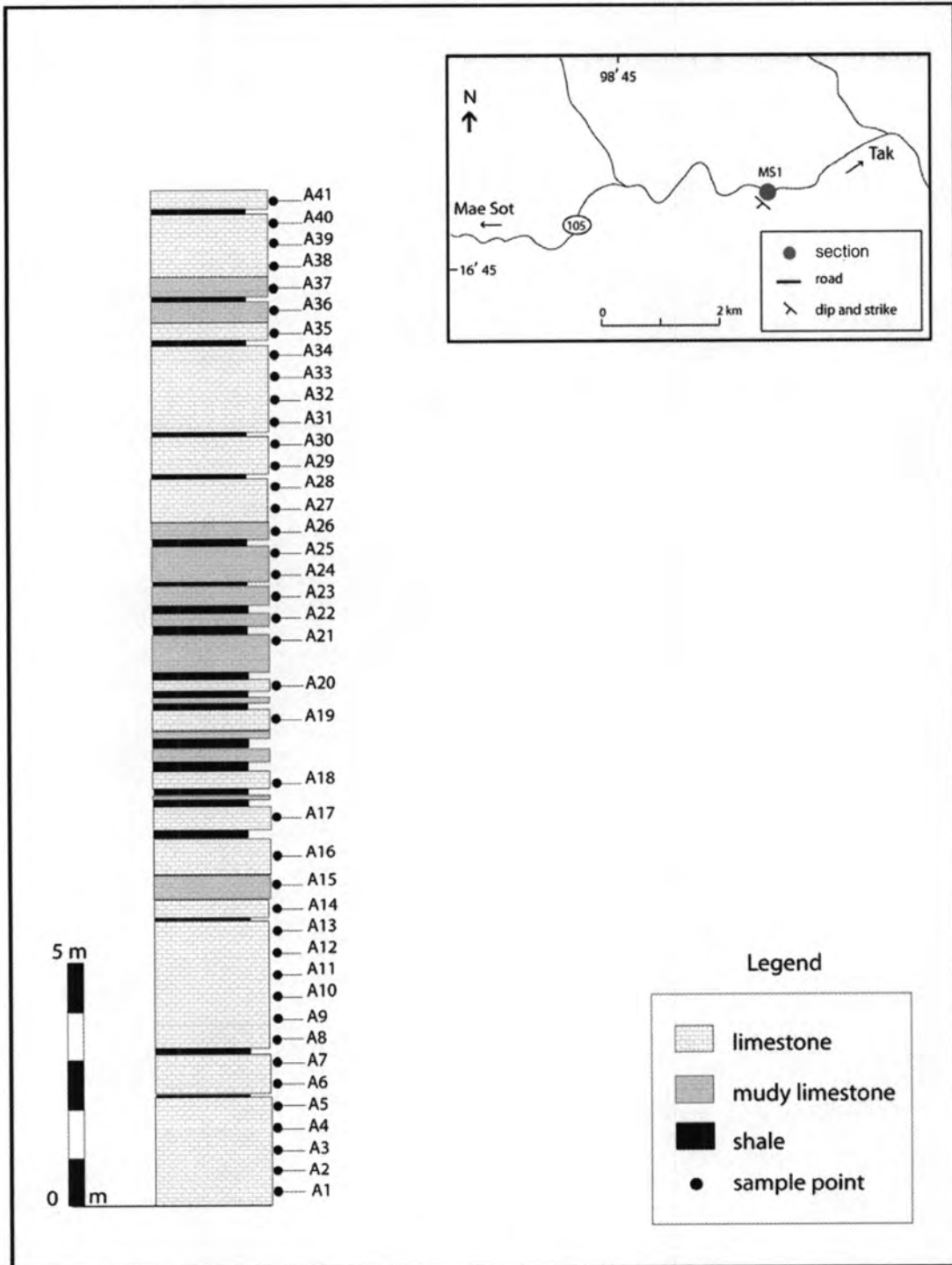


Figure 3.2 Lithostratigraphy of the section MS1.



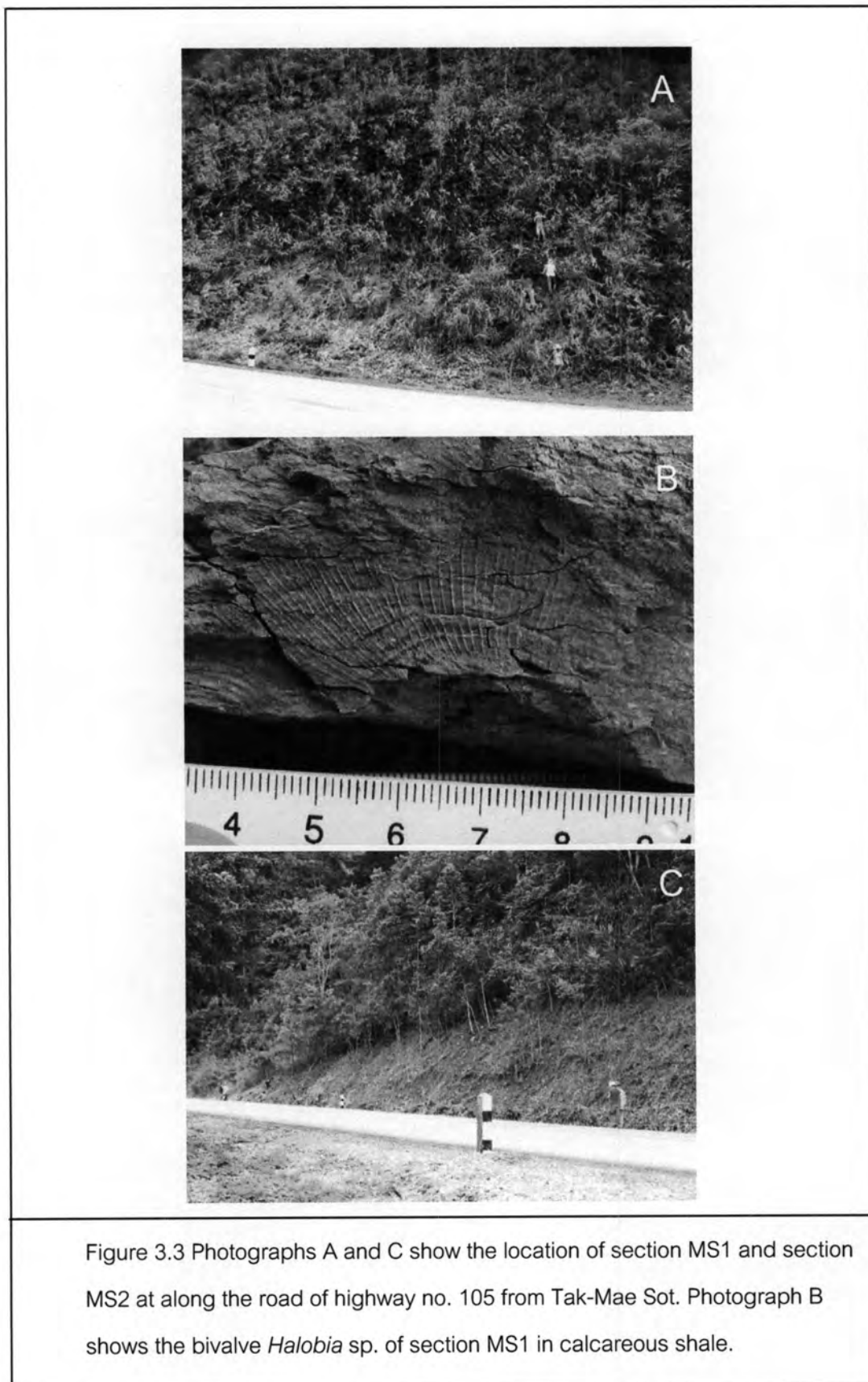


Figure 3.3 Photographs A and C show the location of section MS1 and section MS2 at along the road of highway no. 105 from Tak-Mae Sot. Photograph B shows the bivalve *Halobia* sp. of section MS1 in calcareous shale.



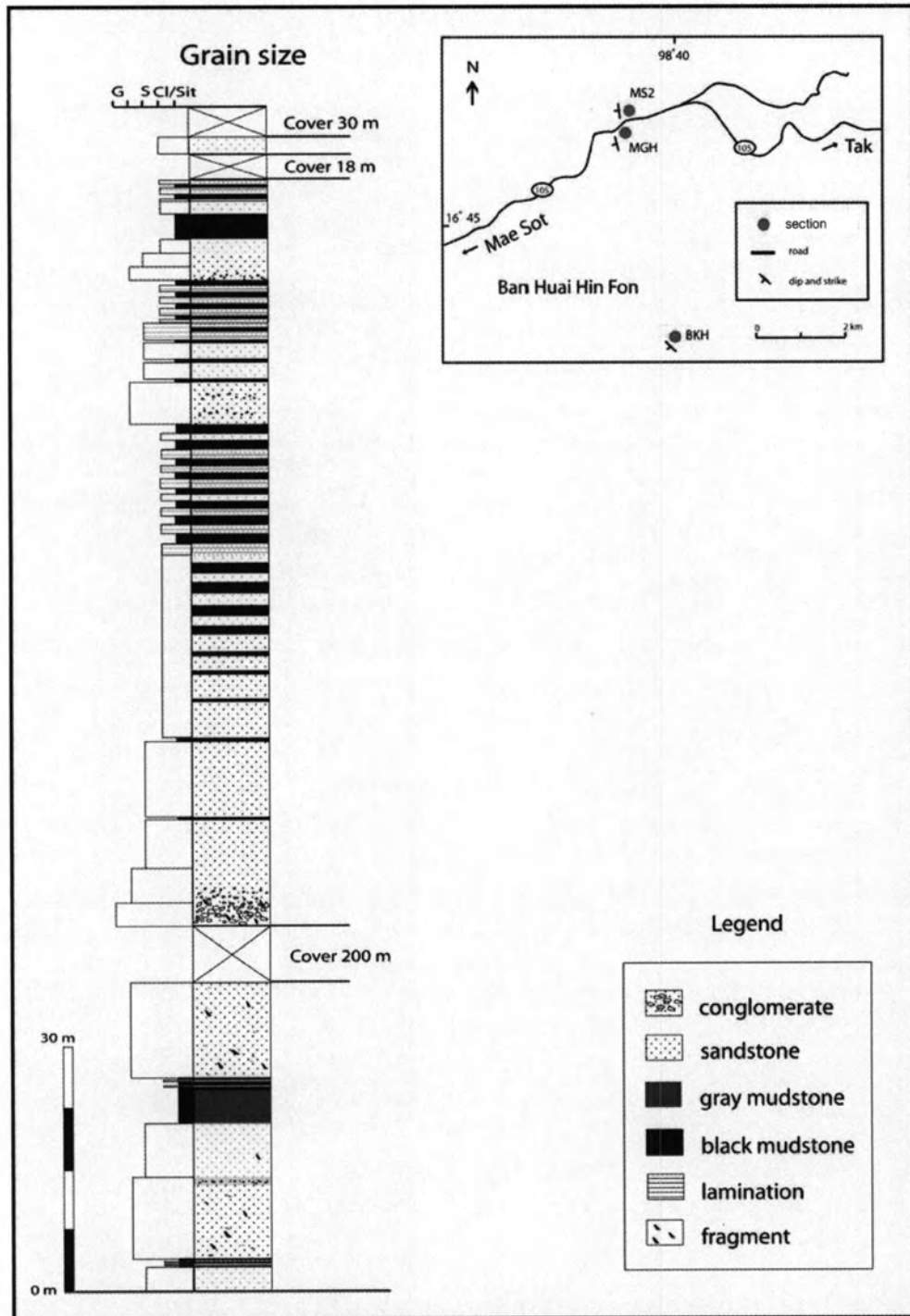


Figure 3.4 Lithostratigraphy of the section MS2.

### 3.1.3 Section MGH (UTM 463122 E, 1853971 N)

Section MGH is located near the magic hill on the highway no. 105, km 70 from Tak to Mae Sot (Figure 3.5). The strata are commonly dark-gray to black, thin well-bedded chert. The attitude of bedding is  $160^{\circ}/27^{\circ}\text{W}$ . The thickness of section is approximately 1.5 m and 12 chert samples have been systematically collected. Thickness of chert bed is varied from 3 to 10 cm. Cherts are composed of abundant radiolarian tests which have been recognized throughout the section. Microscopic studies reveal that the main component of chert is microcrystalline quartz with clay mineral and abundant radiolarian tests (Figure 3.11). The radiolarian size is about 100  $\mu\text{m}$ . The distribution of radiolarian in this section is shown in Figure 3.6. Radiolaria contains *Canoptum rhaeticum* Kozur & Mostler, *Canoptum laxum* Blome, *Canoptum* cf. *levis* Tekin, *Canoptum* sp., *Canoptum* ? sp., *Triassocampe* sp., *Triassocampe* ? sp., *Vinassaspongos* sp., *Vinassaspongos* ? sp., *Capnuchosphaera triassica* De Wever, *Capnuchosphaera* cf. *triassica* De Wever, *Capnuchosphaera* cf. *deweveri* Kozur&Mostler, *Capnuchosphaera* sp., *Capnuchosphaera* ? sp., *Paronaella* sp., *Paleososaturnalis* sp., *Orbiculiforma* sp., *Hagiastrum augustum* Pessagno, *Staurolonche trispinosa* (Kozur and Mostler), *Staurolonche* ? *trispinosa* (Kozur and Mostler), *Pentaspongodiscus* sp., *Dumitricasphaera* sp., *Poulpus* sp., *Castrum peronatum* Blome, *Castrum* ? sp., *Xiphotheca longa* Kozur & Mock, *Xiphotheca* sp., *Annulotriassocampe sulovens* (Kozur and Mock), *Zhamojdasphaera latispinosa* Kozur&Mostler, *Kahlerosphaera* sp., *Ferresium* sp., *Ferresium* ? sp., *Canesium* sp., *Spumellaria* gen. et sp. Indet and *Nessellaria* gen. et sp. Indet and Spine D1. The radiolarian fauna in this section indicates Carnian to Nonian age (Late Triassic).

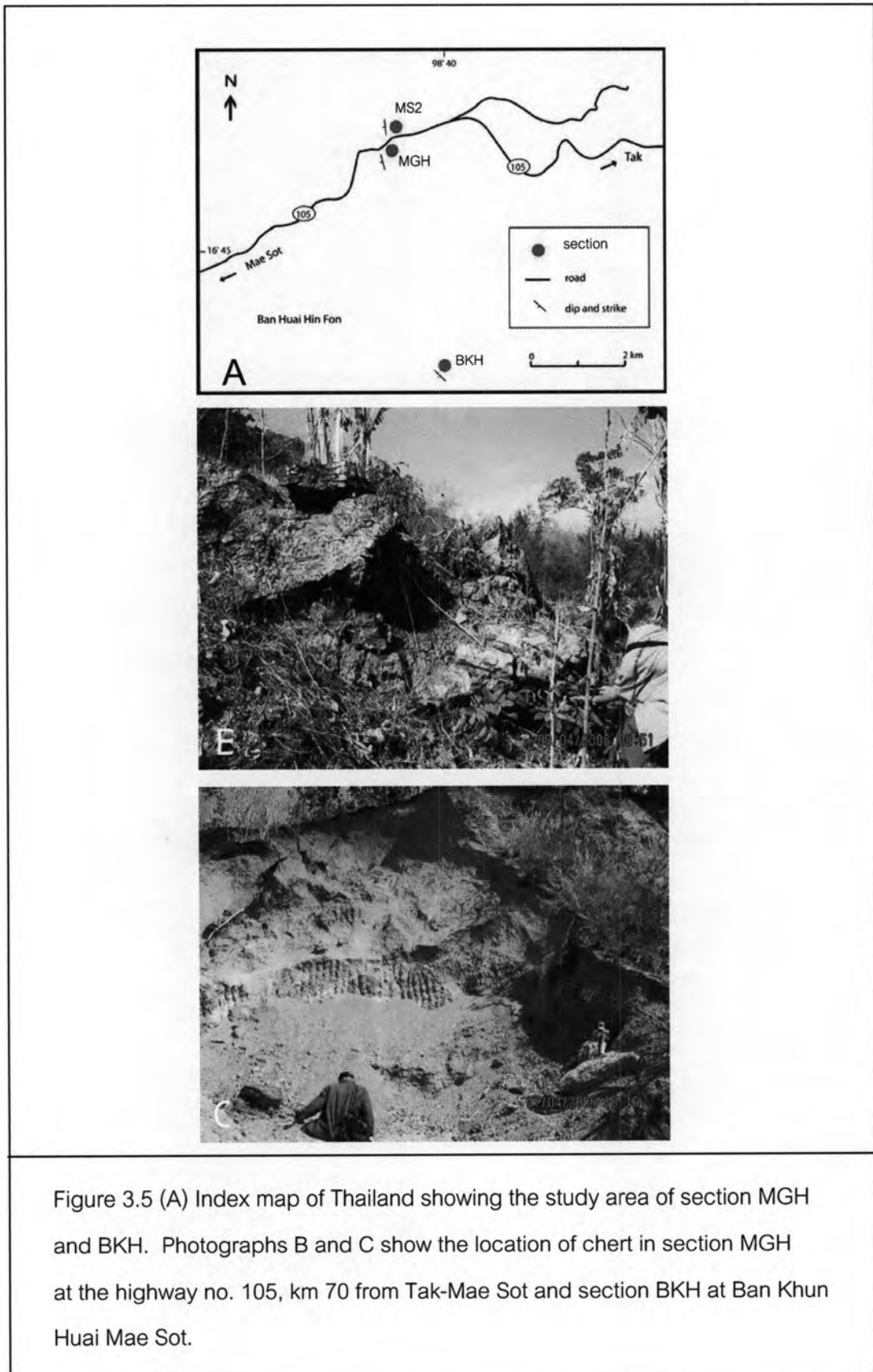
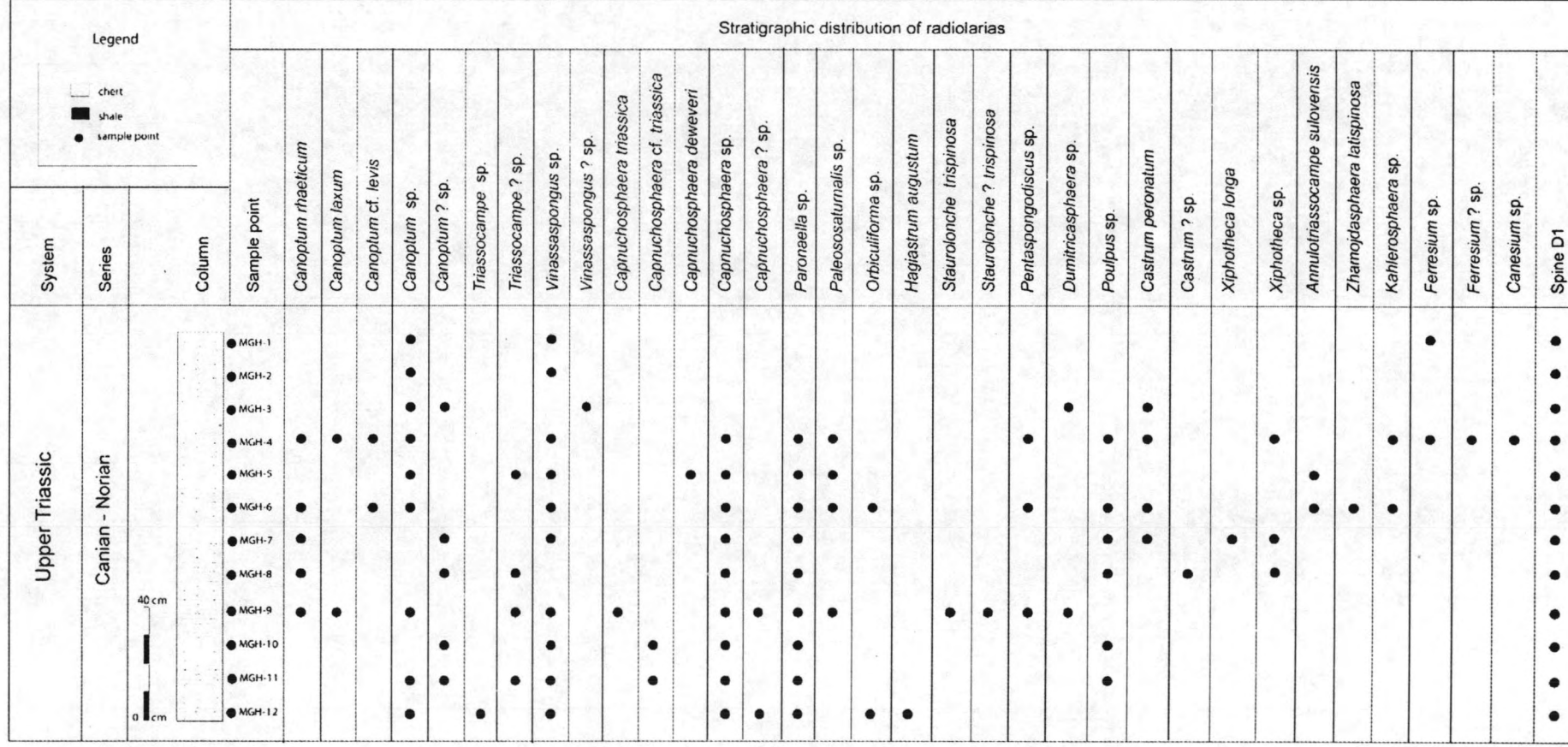




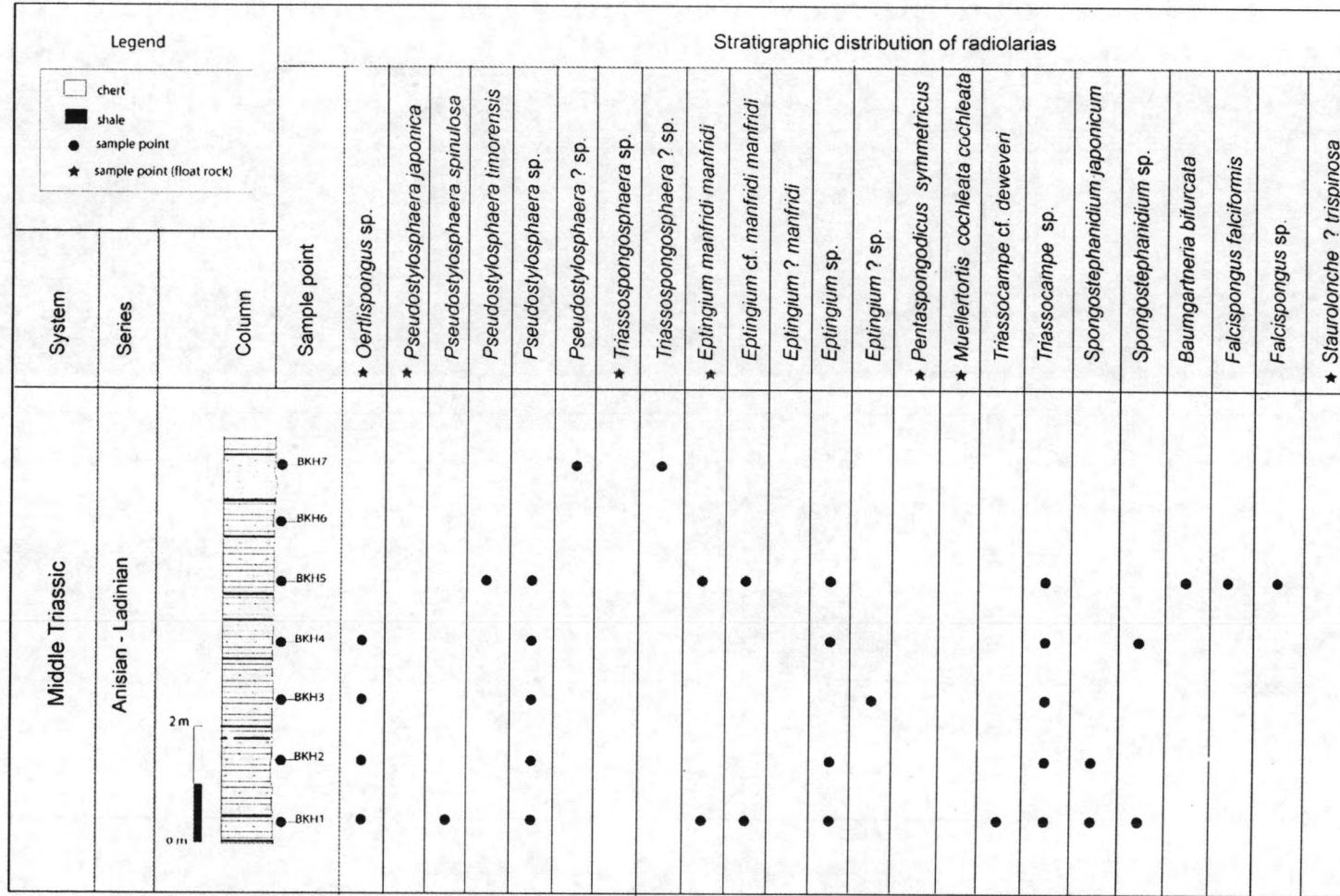
Figure 3.6 Stratigraphic section and distribution of radiolarian fauna from section MGH.



#### 3.1.1.4 Section BKH (UTM 464362 E, 1849404 N)

Section BKH is located at Ban Khun Huai Mae Sot, east of Mae Sot District (see Figure 3.5). The strata were measured at Ban Khun Huai Mae Sot where light gray bedded cherts are well exposed. The attitude of bedding is  $115^{\circ}/15^{\circ}\text{SW}$ . The thickness of section is approximately 11 m and 7 chert samples (BKH1 to BKH7) have been collected in every 1 m including 1 isolated sample. Thickness of each chert bed is varied from 3 to 10 cm. Chert bed in the upper part is intercalated with thin shale. Microscopically, chert consists mainly of microcrystalline quartz associated with clay mineral yielding abundant radiolarians test and fragments of bivalves (Figure 3.12). The distribution of radiolarian in this section is shown in Figure 3.7. Radiolaria consists of *Oertlispongosphaera* sp., *Pseudostylosphaera japonica* (Nakaseko and Nishimura), *Pseudostylosphaera spinulosa* (Nakaseko and Nishimura), *Pseudostylosphaera timorensis* Sashida & Kamata, *Pseudostylosphaera* sp., *Pseudostylosphaera* ? sp., *Triassospongosphaera* sp., *Triassospongosphaera* ? sp., *Eptingium manfridi manfridi*, Dumitrica, *Eptingium* cf. *manfridi manfridi* Dumitrica, *Eptingium* ? *manfridi* Dumitrica, *Eptingium* sp., *Eptingium* ? sp., *Pentaspogodius symmetricus* Dumitrica, Kozur&Mostler, *Muellertortis cochleata cochleata* (Nakaseko and Nishimura), *Triassocampe* cf. *deweveri* (Nakaseko and Nishimura), *Triassocampe* sp., *Spongostephanidium japonicum* (Nakaseko and Nishimura), *Spongostephanidium* sp., *Baumgartneria bifurcata* Dumitrica, *Falcispongosphaera falciformis* Dumitrica, *Falcispongosphaera* sp., *Staurolonche trispinosa* (Kozur and Mostler), Spumellaria gen. et sp. Indet, Conodont. This radiolarian assemblage suggests that the age of rock is Anisian to Ladinian age.

Figure 3.7 Stratigraphic section and distribution of radiolarian fauna from section BKH.

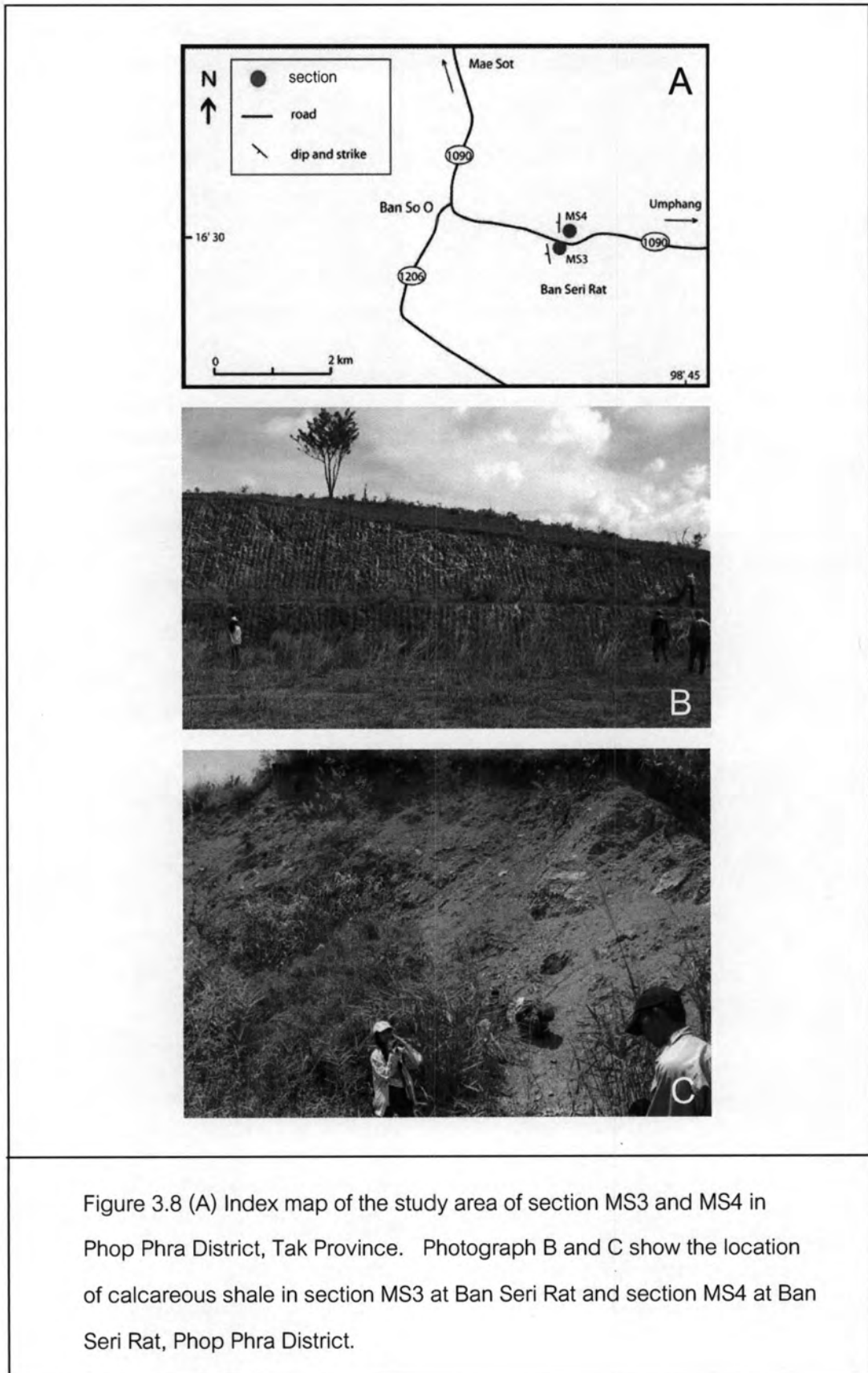


### 3.1.5 Section MS3 (UTM 704470 E, 1824118 N)

Section MS3 is located along the highway no. 1090, km33+800 from Mae Sot to Phop Phra (Figure 3.8). The attitude of bedding is  $175^{\circ}/34^{\circ}\text{W}$ . The thickness of section is approximately 50 m. The rocks consist of dark gray mudstones, interbedded with siltstone and shale in the middle part of the section. Sandstone lenses have been observed in the upper part. Bivalves such as *Halobia* sp. were mainly found in the dark gray mudstone (Figure 3.9). This characteristic bivalve suggests Upper Triassic age.

### 3.1.6 Section MS4 (UTM 707470 E, 1824401 N)

Section MS4 is located along the road of highway no. 1090, km34+100 from Mae Sot to Phop Phra (Figure 3.8). The attitude of bedding is  $180^{\circ}/45^{\circ}\text{W}$ . The rocks consist of dark gray mudstone, siltstone and calcareous shale. They are highly weathered. Thickness of each bed is between 10-20 cm. Bivalves (e.g. *Halobia* sp.) and ammonites (Figure 3.9) found in this section suggest Upper Triassic in age.





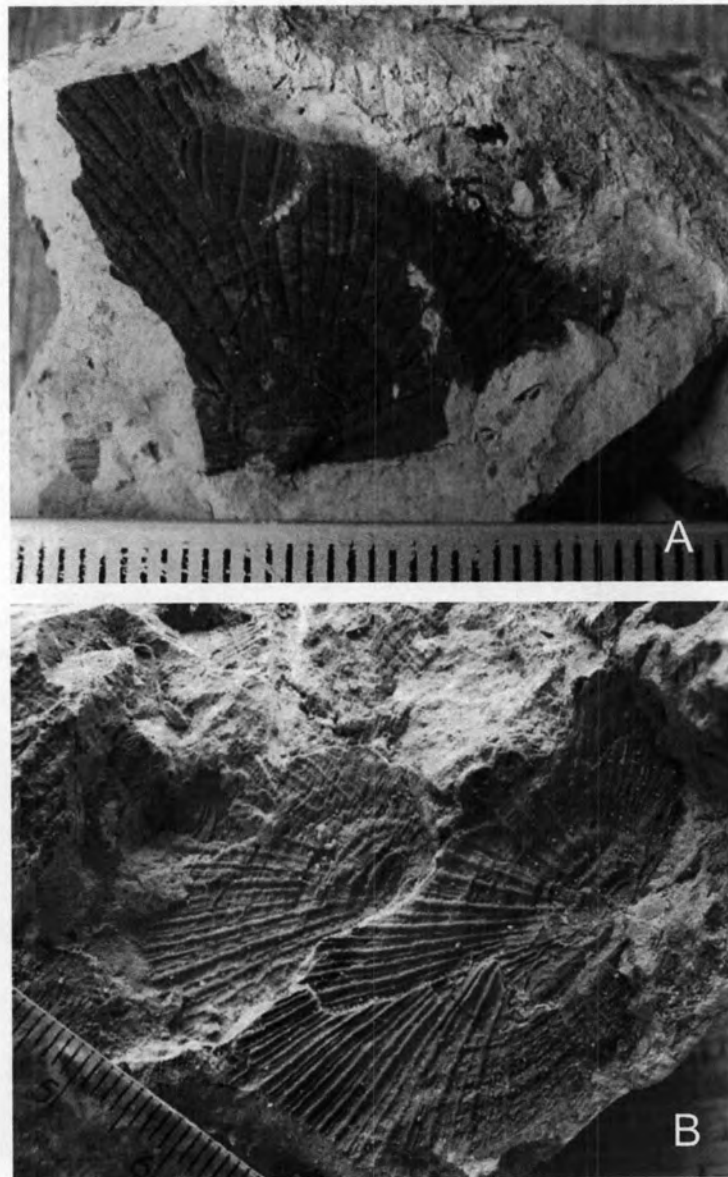


Figure 3.9 Photographs of the bivalve *Halobia* sp. (A) Section MS3 at Ban Seri Rat. (B) Section MS4 at Ban Seri Rat (scale in cm).

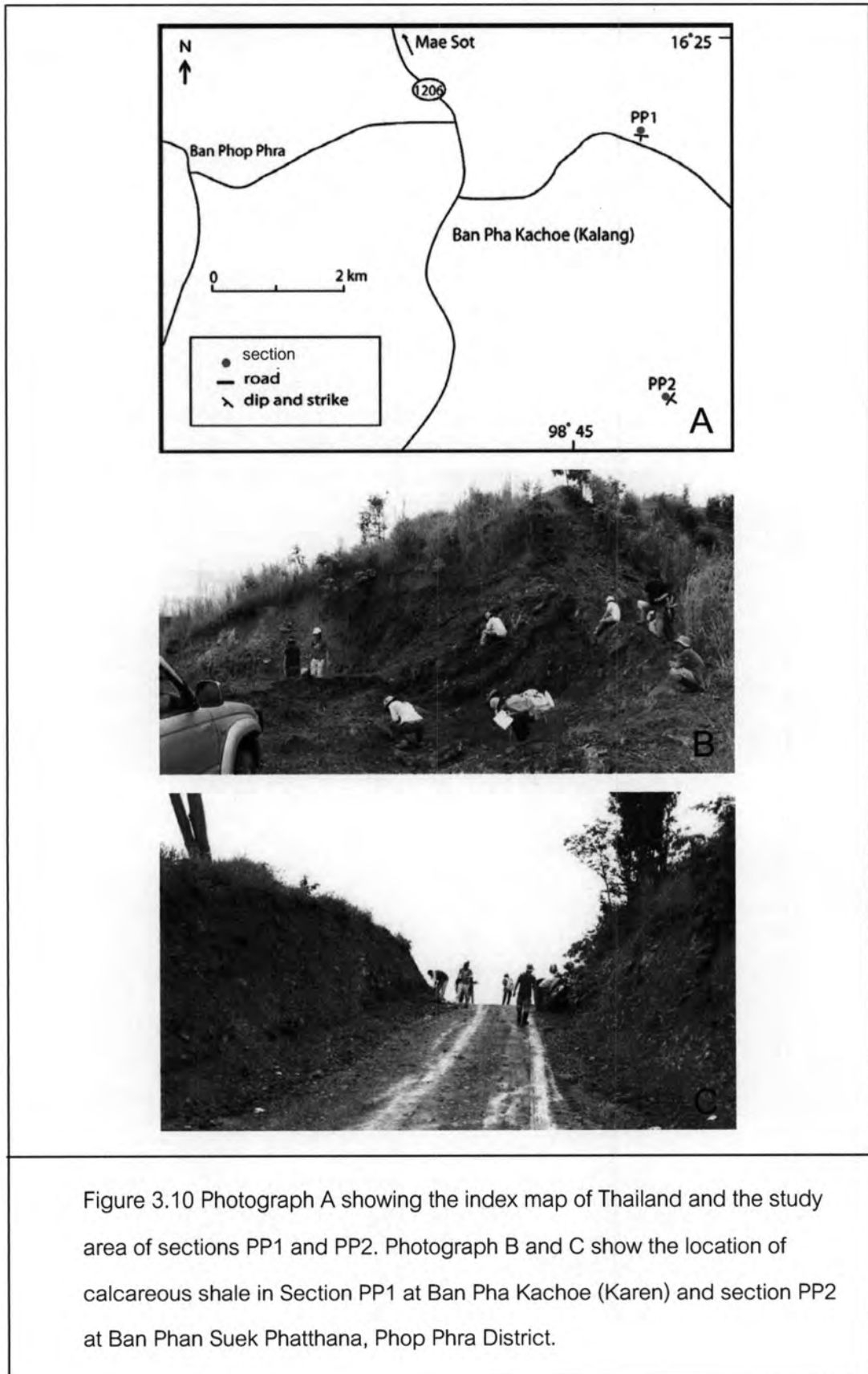


### 3.1.7 Section PP1 (UTM 474451 E, 1813698 N)

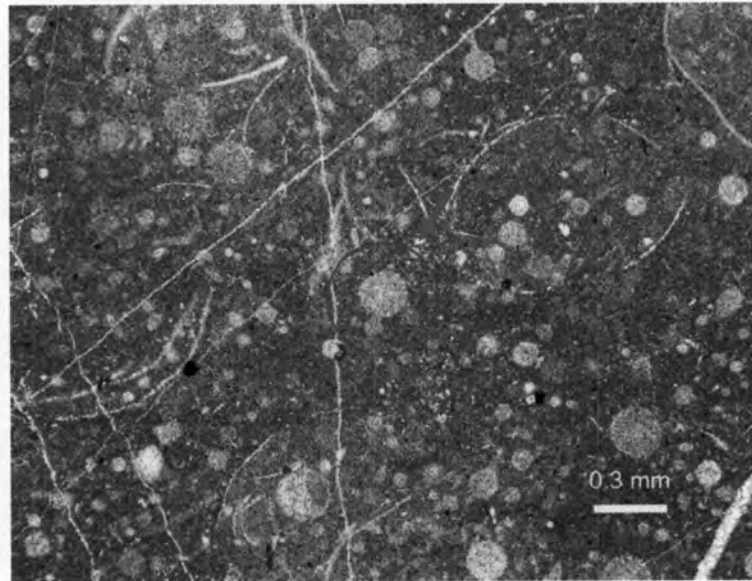
Section PP1 is located at Ban Pha Kachoe (Karen) on the highway no. 1206 from Mae Sot to Phop Phra (Figure 3.10). The attitude of bedding is  $100^{\circ}/34^{\circ}\text{S}$ . The rocks consist of calcareous shale. This section contains thin-shell bivalve *Halobia* sp. and ammonite found in calcareous shale. The thickness of section is approximately 10 m. Microscopically, calcareous shale contains fauna skeletons and quartz grains. (Figure 3.13). Bivalve (*Halobia* sp.) found in this section suggests Upper Triassic.

### 3.1.8 Section PP2 (UTM 474941 E, 1809655 N)

Section PP1 is located at Ban Phan Suek Phatthana on the highway no. 1206 from Mae Sot to Phop Phra (Figure 3.10). The attitude of bedding is  $40^{\circ}/25^{\circ}\text{SE}$ . This section contains Upper Triassic fauna such as *Halobia* sp. and ammonite which are found in calcareous shale. The thickness of section is approximately 40 m. Microscopically, some fauna skeletons have been observed. (Figure 3.14).



A)



B)

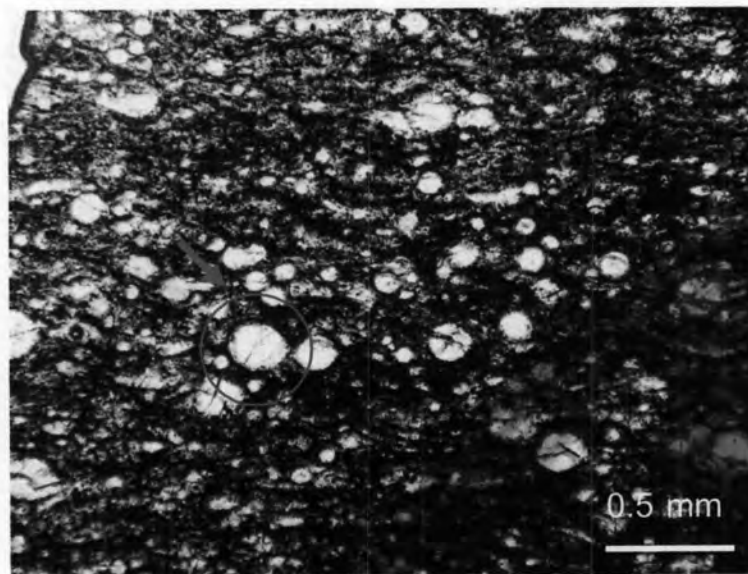
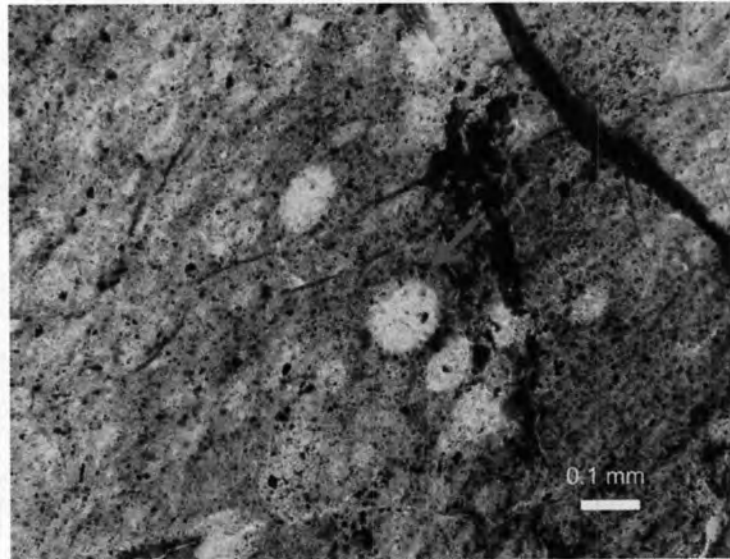


Figure 3.11 Photomicrograph A show of muddy limestone sample no. A23 of the section MS1, showing radiolarian fauna. (B) Photomicrograph of chert sample of the section MGH, showing radiolarian fauna.

A)



B)

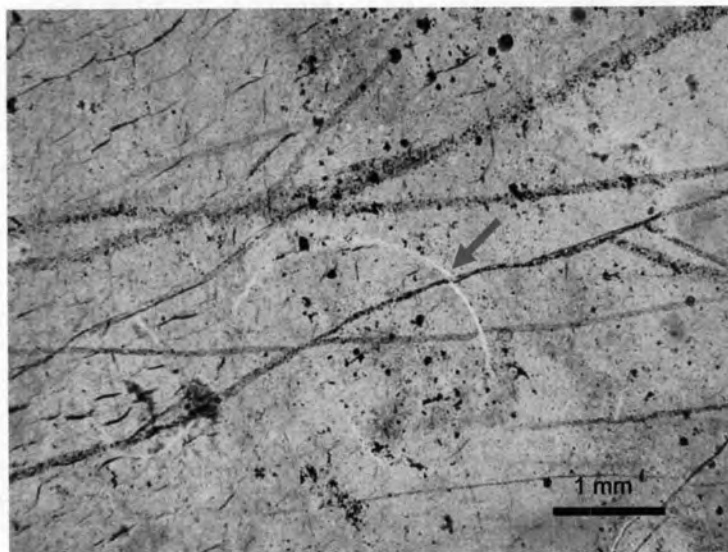
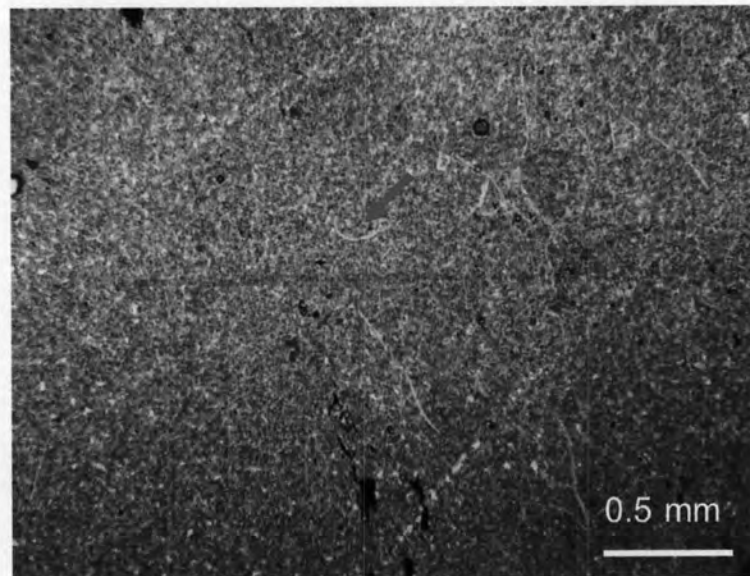


Figure 3.12 Photomicrograph A shows chert sample of the section BKH1, showing radiolarian fauna. Photomicrograph B shows fragments of bivalves of the section BKH.

A) PPL



B) XPL

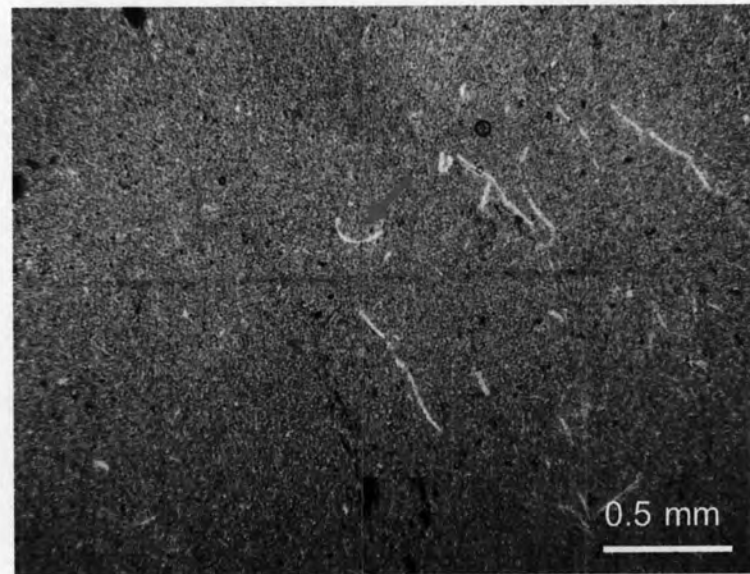
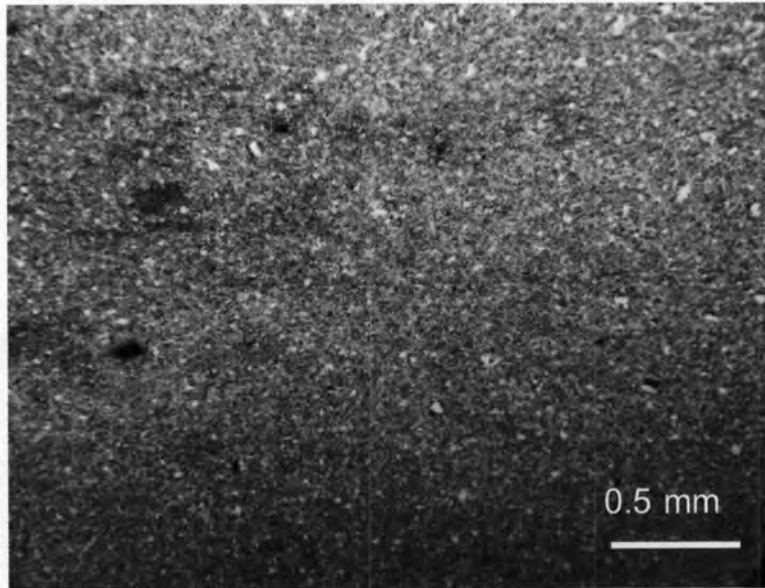


Figure 3.13 Photomicrographs of calcareous shale of the section PP1, showing fragments of bivalves and grains of quartz.

A) PPL



B) XPL

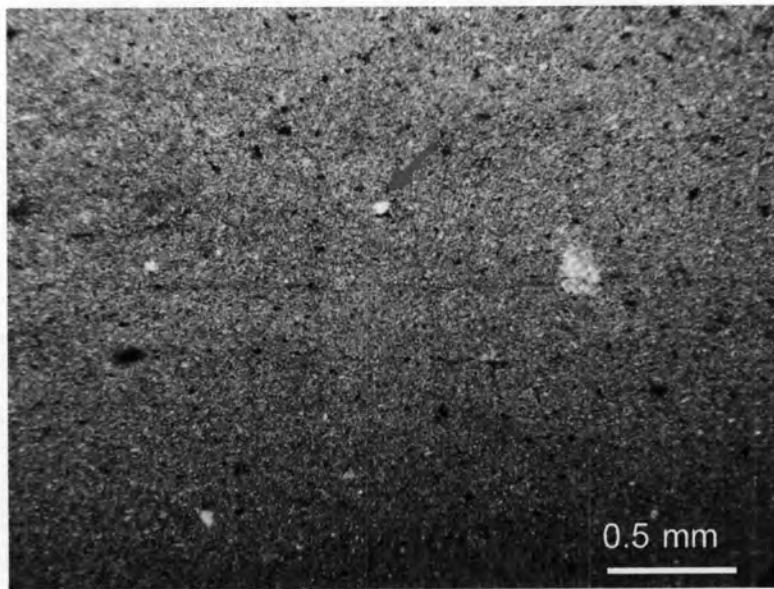


Figure 3.14 Photomicrographs of calcareous shale of the section PP1, showing grains of quartz.



### 3.2 Radiolarian biostratigraphy and age determination

Twenty-four chert samples have been collected from various levels of the two sections (MGH section and BKH section). Of these, 19 samples have yielded radiolarian fauna. The radiolarian fauna found in this study consists of 26 genera and 43 species indicating Anisian to Norian age.

#### 3.2.1 Section MGH

Radiolarian fauna found in this section consists of 18 genera and 26 species (Table 3.1). Twelve samples were collected from this section. Radiolarians are composed of *Canoptum rhaeticum* Kozur & Mostler, *Canoptum laxum* Blome, *Canoptum* cf. *levis* Tekin, *Canoptum* sp., *Canoptum* ? sp., *Triassocampe* sp., *Triassocampe* ? sp., *Vinassaspongius* sp., *Vinassaspongius* ? sp., *Capnuchosphaera triassica* De Wever, *Capnuchosphaera* cf. *triassica* De Wever, *Capnuchosphaera* cf. *deweveri* Kozur&Mostler, *Capnuchosphaera* sp., *Capnuchosphaera* ? sp., *Paronaella* sp., *Paleososaturnalis* sp., *Orbiculiforma* sp., *Hagiastrum augustum* Pessagno, *Staurolonche trispinosa* (Kozur and Mostler), *Staurolonche* ? *trispinosa* (Kozur and Mostler), *Pentaspongodiscus* sp., *Dumitricasphaera* sp., *Poulpus* sp., *Castrum peronatum* Blome, *Castrum* ? sp., *Xiphotheca longa* Kozur & Mock, *Xiphotheca* sp., *Annulotriassocampe sulovensis* (Kozur and Mock), *Zhamojdasphaera latispinosa* Kozur&Mostler, *Kahlerosphaera* sp., *Ferresium* sp., *Ferresium* ? sp. and *Canesium* sp. The occurrence of *Capnuchosphaera* De Wever, *Capnuchosphaera deweveri* Kozur&Mostler and *Capnuchosphaera triassica* De Wever which have been recognized from early Carnian of TR 5A (Sugiyama,1997). *Capnuchosphaera triassica* De Wever, is also the characteristic fauna of Carnian to Norian of *Triassocampe nova* Assemblage (Yao,1982). Yoshida (1986) reported that *Capnuchosphaera* and *Kahlerosphaera* group are characteristics of *Capnuchosphaera* Zone, and age of this zone is estimated to be late Carnian. *Canoptum rhaeticum* Kozur & Mostler indicates late Norian to Rhaetian of TR8C (Sugiyama, 1997). According to the occurrence of *Capnuchosphaera triassica* De Wever in this section, it can be concluded that the age of the strata is Carnian to Norian (Late Triassic).



### 3.2.2 Section BKH

Radiolarian fauna found in this section, consists of 9 genera and 19 species (Table 3.2). Radiolarians identified from this section include *Oertlispongosphaera* sp., *Pseudostylosphaera japonica* (Nakaseko and Nishimura), *Pseudostylosphaera spinulosa* (Nakaseko and Nishimura), *Pseudostylosphaera timorensis* Sashida & Kamata, *Pseudostylosphaera* sp., *Pseudostylosphaera* ? sp., *Triassospongosphaera* sp., *Triassospongosphaera* ? sp., *Eptingium manfridi manfridi* Dumitrica, *Eptingium* cf. *manfridi manfridi* Dumitrica, *Eptingium* ? *manfridi* Dumitrica, *Eptingium* sp., *Eptingium* ? sp., *Pentaspogodicus symmetricus* Dumitrica, Kozur & Mostler, *Muellertortis cochleata cochleata* (Nakaseko and Nishimura), *Triassocampe* cf. *deweveri* (Nakaseko and Nishimura), *Triassocampe* sp., *Spongostephanidium japonicum* (Nakaseko and Nishimura), *Spongostephanidium* sp., *Baumgartneria bifurcata* Dumitrica, *Falcispongosphaera falciformis* Dumitrica, *Falcispongosphaera* sp. and *Staurolonche trispinosa* (Kozur and Mostler). The occurrence of *Triassocampe* cf. *deweveri* (Nakaseko and Nishimura), *Eptingium manfridi manfridi* Dumitrica, *Pseudostylosphaera japonica* (Nakaseko and Nishimura), *Baumgartneria bifurcata* Dumitrica, *Muellertortis cochleata cochleata* (Nakaseko and Nishimura) are diagnostic of TR2C-TR4A (Sugiyama, 1997) during late Anisian to late Ladinian. The occurrence of *Eptingium manfridi* and *Baumgartneria bifurcata* Dumitrica suggests the late Anisian of TR2C and TR3A (Sugiyama, 1997). *Muellertortis cochleata cochleata* (Nakaseko and Nishimura) has been described from the late Ladinian of TR4A (Sugiyama, 1997). *Pseudostylosphaera timorensis* Sashida & Kamata is a characteristic species of Middle Triassic (Ladinian) age (Sashida et al., 1999). *Triassocampe deweveri* (Nakaseko and Nishimura) and *Eptingium* cf. *manfridi*, which were described from late Ladinian and earlier of *Triassocampe deweveri* Assemblage (Yao, 1982). Therefore, the geological age of the radiolarian fauna in this section is estimated to be late Anisian to late Ladinian.

Table 3.2 List of Triassic radiolarians from the section BKH, Mae Sot area.

Species name	Sample number						
	BKH L.B	BKH1	BKH2	BKH3	BKH4	BKH5	BKH7
<i>Oertlispongus</i> sp.	+	+	+	+	+		
<i>Pseudostylosphaera japonica</i> (Nakaseko and Nishimura)	+						
<i>Pseudostylosphaera spinulosa</i> (Nakaseko and Nishimura)		+					
<i>Pseudostylosphaera timorensis</i> Sashida & Kamata						+	
<i>Pseudostylosphaera</i> sp.		+	+	+	+	+	
<i>Pseudostylosphaera</i> ? sp.							+
<i>Triassospongosphaera</i> sp.	+						
<i>Triassospongosphaera</i> ? sp.							+
<i>Eptingium manfridi manfridi</i> Dumitrica	+	+				+	
<i>Eptingium cf. manfridi manfridi</i> Dumitrica		+				+	
<i>Eptingium</i> sp.		+	+		+	+	
<i>Eptingium</i> ? sp.				+			
<i>Pentaspongodicus symmetricus</i> Dumitrica, Kozur & Mostler	+						
<i>Muelleritortis cochleata cochleata</i> (Nakaseko and Nishimura)	+						
<i>Triassocampe cf. deweveri</i> (Nakaseko and Nishimura)		+					
<i>Triassocampe</i> sp.		+	+	+	+	+	
<i>Spongostephanidium japonicum</i> (Nakaseko and Nishimura)		+	+				
<i>Spongostephanidium</i> sp.		+			+		
<i>Baumgartneria bifurcata</i> Dumitrica						+	
<i>Falcispongus falciformis</i> Dumitrica						+	
<i>Falcispongus</i> sp.						+	
<i>Staurolonche cf. Inspinosa</i> (Kozur and Mostler)	+						
<i>Spumellaria</i> gen. et sp. indet	+	+	+	+	+	+	+
Conodont	+						

### 3.3 Correlation

#### 3.3.1 Radiolaria correlation

This chapter presents the correlation of radiolarian assemblage found in this study and other parts of the world based on the zonal schemes proposed by Yao, 1982; Sugiyama, 1997; Pessagno et al., 1979; Blome, 1984; Kozur and Mostler, 1994 (Table 3.3). The correlation of radiolarian fauna found from 2 chert sections: section BKH and section MGH in this area is shown as follow:

Section BKH is characterized by *Eptingium manfridi* Dumitrica, *Triassocampe* cf. *deweveri* (Nakaseko and Nishimura), *Oertlispongos* sp., *Falcispongos falciformis* Dumitrica, *Baumgartneria bifurcata* Dumitrica, *Muellertortis cochleata cochleata* (Nakaseko and Nishimura), *Pseudostylosphaera japonica* (Nakaseko and Nishimura) and *Pseudostylosphaera spinulosa* (Nakaseko and Nishimura). It can be correlated to *Eptingium manfredi* assemblages in Thailand (Shasida and Igo, 1999), *Triassocampe deweveri* assemblages (Yao, 1982), TR2C to TR4A Zone of Sugiyama (1997) in Japan and to the *Spongosiicarmiger italicus*, *Ladinocampe multiperforata*, *Mulleritortis cochleata* and lower part of *Tritortis kretaensis* Zone of Kozur and Mostler (1994) in Europe. Thus, the age of this section is Anisian to Ladinian (Middle Triassic).

Section MGH is characterized by *Capnuchosphaera triassica* De Wever, *Capnuchosphaera* cf. *deweveri* Kozur & Mostler, *Capnuchosphaera* sp., *Kahlerosphaera* sp., *Canoptum* sp., *Ferresium* sp. and *Canoptum rhaeticum* Kozur & Mostler. It can be correlated to *Triassocampe nova* assemblages of Yao (1982), TR5A to TR5A and TR8C Zones of Sugiyama (1997) in Japan, *Capnodoce* Zone and *Betraccium* Zone of Blome (1984) in North America and correlated with *Capnodoce ruesti* Zone and the lower part of *Livarella densiporata* Zones of Kozur and Mostler (1994) in Europe. The age of this section can be indicated as Carnian to Norian (Late Triassic).



Table 3.3 Correlation of Triassic radiolarian zones of the Mae Sot - Phop Phra area with those of Thailand, Japan, North America and Europe (N. Wonganun, personal communication).

TIME SCALE	NORTH AMERICA		EUROPE		FAR EAST RUSSIA	YAO (1982) SUGIYAMA (1992) YAO & KUWAHARA (1997)	JAPAN			NORTH THAILAND
	BLOME (1984)	YEH (1989)	KOZUR & MOSTER (1994)	KOZUR & MOSTER (1996)	BRAGIN (1991)	SATO et al. (1982)	YOSHIDA (1986)	SASHIDA (1993)	SUGIYAMA (1997)	Wonganun
LATE TRIASSIC	RIIARTIAN				<i>Livarella glauca</i>	<i>Canagium thalassicum</i>			<i>Haecchelesium brevior</i>	
		210	<i>Betraccium deweveri</i> <i>Pantocellum siberlingi</i>	<i>Orbiculiformis</i> sp. A		<i>Betraccium deweveri</i>	<i>Betraccium deweveri</i>	<i>Betraccium deweveri</i>	<i>Skiri F.L.</i> <i>Prasemosaurialis pseudohaberi</i> <i>Prasemosaurialis multidentatus</i>	
	215	<i>Lattum puricum</i> <i>Xipha spicata</i>	<i>Corum parvum</i>	<i>Capnodocce ruzesi</i>	<i>Capnodocce untiqae</i>		<i>Acanthocircus-Pseudoheliodiscus</i>		<i>Lysmelas othia</i>	
	220	<i>Austium novum</i>		<i>Nakasekiellus interseus</i>	<i>Capnuchosphaera lea</i>	<i>Triassicampe nova</i>	<i>Capnodocce</i>	<i>Betraccium</i> sp.	<i>Triallatus robustus</i> <i>Lysmelas othia</i>	<i>Japonicampe nova</i> gr. - <i>Multidentata</i>
	CARNIAN		<i>Ponipus karriensis</i>	<i>Tetraprobrachia heudehli</i> UNNAMED <i>Tetronia brevis</i>	<i>Platiferum cochleatum</i>		<i>Capnuchosphaera triassica</i>	<i>Capnuchosphaera</i>	<i>Capnodocce-Triallatus</i>	<i>Japonicampe nova</i> gr. - <i>Capnuchosphaera</i>
MIDDLE TRIASSIC	230	<i>Pseudostylosphaera mogiensponosa</i>	<i>Muelletiana cochleata</i> <i>S. fuzgeri</i> <i>S. rarosana</i> <i>P. praeas</i>	<i>Ladinocampe multiplicata</i> <i>Spongosticium mageritica</i> <i>S. trinitatis</i> <i>Tetraspinocyrtus laevis</i>	<i>Sarka diplocha</i> <i>Tethuria elegans</i>	<i>Triassicampe deweveri</i>	<i>Emilivus cochleata</i>	<i>Crypsosphaeridium</i> sp.	<i>Muelletiana cochleata</i> <i>Spongostrella dehli</i>	<i>Triassicampe nova</i> gr. - <i>Pseudoheliodiscus primitivus</i> <i>Muelletiana cochleata</i>
	235		<i>M. firma</i>					ISOGAWA et al. (1982)		<i>Triassicampe deweveri</i> - <i>T. scalaris</i>
	ANISIAN		<i>Paraspongon robustus</i>					<i>Tibosella florida</i> <i>Triassicampe coronata</i>		<i>Annalobiazocampe coronata</i>
	240						<i>Triassicampe coronata</i>	<i>Hozmadia ozumai</i>	<i>Epangium nakaseki</i> <i>Parentactinia nakatsugawensis</i>	<i>Hozmadia</i> sp.
EARLY TRIASSIC	OLENEKIAN					<i>Triassicampe coronata</i> <i>Hozmadia glauca</i> <i>Parentactinia nakatsugawensis</i> "Sphaeroidis"	<i>Parentactinia nakatsugawensis</i>	<i>Parentactinia nakatsugawensis</i>	<i>Follicullus Parentactinia</i> ?	<i>Sponclitana</i>
245	INDUAN									
248										





### 3.3.2 Stratigraphic correlation

The 8 studied sections: BKH, MS2, MGH, MS3, MS4, PP1, PP2 and MS1 can be lithologically divided into 3 groups. They are composed of turbidite sequence (MS2, MS3, MS4, PP1, and PP2), chert sequence (BKH, MGH) and pelagic limestone (MS1). All sections can be correlated based on the same time span (Figure 3.15). Two chronozones : Anisian to Ladinian, and Carnian to Norian, have been established based on the range of radiolarian fauna.

#### 3.3.2.1 Anisian to Ladinian

This chronozone is based on the sequence of diagnostic radiolarians *Eptingium manfridi* Dumitrica, *Triassocampe* cf. *deweveri* (Nakaseko and Nishimura), *Oertlispongus* sp., *Falcispongus falciformis* Dumitrica, *Baumgartneria bifurcata* Dumitrica, *Muellertortis cochleata cochleata* (Nakaseko and Nishimura), *Pseudostylosphaera japonica* (Nakaseko and Nishimura) and *Pseudostylosphaera spinulosa* (Nakaseko and Nishimura) found in the section BKH, indicating Anisian to Ladinian (Middle Triassic). The section MS2 probably lithostratigraphically corresponds to the turbidite sequence, Tr1 (Saengsrichan, 2006 unpublished data) which is occupied the lower part of the Mae Sariang Group of Middle Triassic (Srinak, 2002).

#### 3.3.2.2 Carnian to Norian

Well bedded limestone of section MS1 yielding characteristic radiolarians *Capnuchosphaera* sp. (Late Triassic), calcareous shale bearing *Halobia* sp. (Late Triassic), and ribbon chert containing diagnostic radiolarians *Capnuchosphaera triassica* De Wever, *Capnuchosphaera* cf. *deweveri* Kozur&Mostler, *Capnuchosphaera* sp., *Kahlerosphaera* sp., *Canoptum* sp., *Ferresium* sp. and *Canoptum rhaeticum* Kozur & Mostler found in the section MGH, indicating Late Triassic, can be equivalent in age to the total maximum time span of the presence of these faunas.

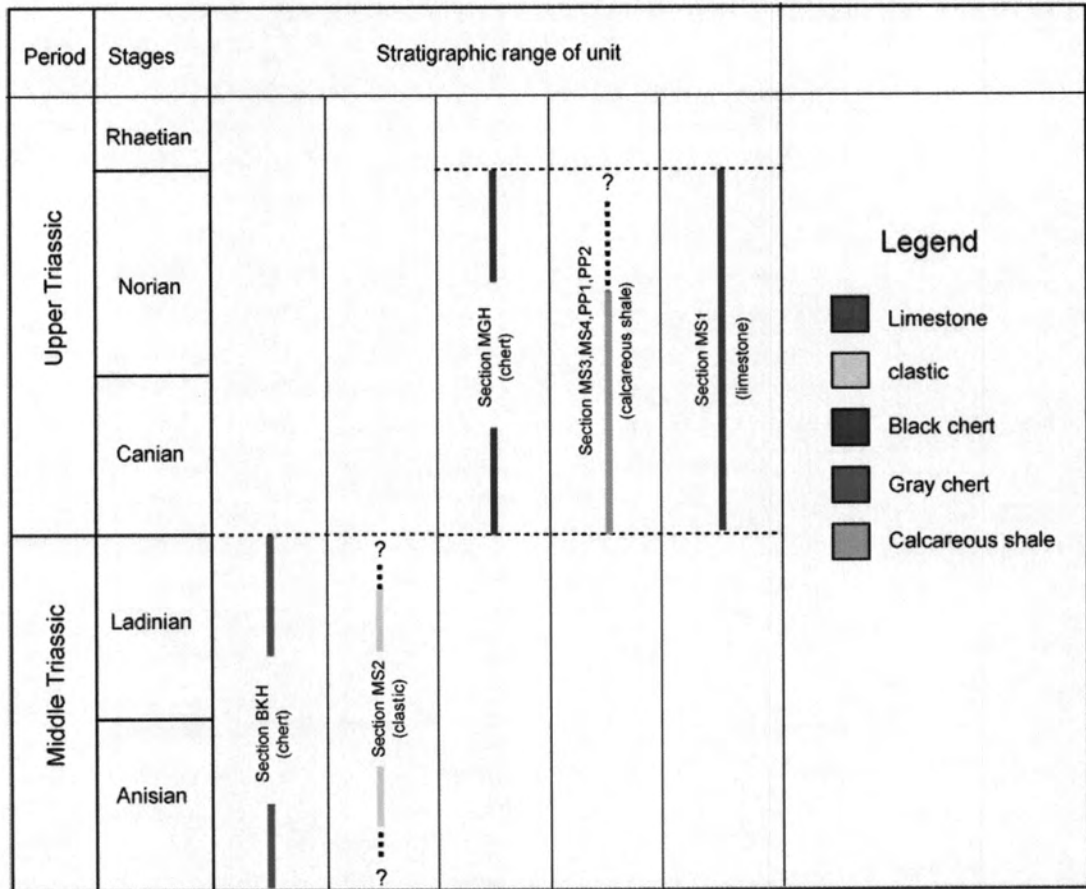


Figure 3.15 Schematic stratigraphic ranges of units in the Mae Sot-Phop Phra area.