บทคัดย่อ

หินปูน ในอำเภอบึงสามพัน จังหวัดเพชรบูรณ์ ไม่เพียงแต่ประกอบด้วยฟอสซิลที่หลากหลาย ได้แก่ ปะการัง, แบคคลีโอพอด, หอย, รูโกซ่า, แอมโมนอยด์, ฟองน้ำ และ ไบโอซัว แต่ยังมีฟอสซิลปลา อีกด้วย จากการค้นพบใน field work 2 เราได้เตรียม geologic map และจำแนก geomorphic surface ในพื้นที่ศึกษา โดยใช้ สเกล 1:25,000 และได้ตัดสินใจ ตำแหน่งที่จะทำ stratigraphy ในพื้นที่ที่พบฟอสซิลปลา หลังจากนั้นได้ใช้ lithology และ sedimentary structure ในการที่จะสร้างสภาพแวดล้อมโบราณใหม่ว่าเป็นอย่างไร

ฟอสซิลปลามีอยู่ในชั้นหิน 2 ชั้น ชั้นแรกเป็นชั้นเดียวกันกับ Crinoid limestone (ชั้นที่ 1) สีของหินปูนนี้เป็นสีม่วงแดง และกระจายตัวอยู่ทั่วไปขนานแนว bedding plane และอีกหนึ่งชั้นอยู่ใน alternation limestone หนาประมาณ 10-20 เซนติเมตร และมี black shale หนาประมาณ 1-2 เซนติเมตรด้วย หินปูนนี้มีส่วนที่เป็น laminated อยู่บน surface ประกอบกับมีร่องรอยการคลืบคลานของสัตว์ปรากฏให้เห็นด้วย จึงเชื่อว่า สภาพแวดล้อมเล็กๆในบริเวณนั้น เป็น lagoonal swamp ที่บางครั้งก็มีการรุกร้ำของน้ำจืด ในบริเวณนี้แรกเริ่มเดิมทีมีสภาพแวดล้อมที่เป็นน้ำจืด ซึ่งต่อมาอาจจะมีการวิวัฒนาการมาเป็นสภาพแวดล้อมที่เป็นน้ำทะเล

โดยส่วนใหญ่แล้ว ฟอสซิลปลาจะพบส่วนที่อยู่บนของร่างกาย เช่น เกล็ดปลาที่มีรูปร่างคล้ายเพชร เป็นต้น จะไม่พบกะโหลกศรีษะ จากลักษณะของเกล็ดปลาในตัวอย่างที่ปรากฏให้เห็นพบว่ามันอยู่ใน Osteichthyes (Class), Chondrostei (Superorder), Palaeochondrostei (Superorder), Paleonisciforms (Order) โดยสังเกตจากลักษณะเกล็ดปลาที่เรียกว่า “Ganoid” ตามที่มีรายงานฟอสซิลปลานี้จากประเทศจีน (Lu and Ma,1973)

Abstract

Limestones in Amphoe Bueng Samphan, Phetchabun, contain not only abundant coral building animals, Brachiopods, Mollusca, Rugosa, Ammonoids, Calcareous sponges and Bryozoans, but fish fossils. The discovery was in the course of field work II. First of all, I prepared the geologic map and classified geomorphic surfaces in study area scaled 25,000 and determined stratigraphical position of fish fossil localities. And after that, by using lithology and sedimentary structures in limestone. paleoenvironments are reconstructed.

Fish fossils are two horizons. The first one is the same locality with Crinoid limestone (Horizon 1). The color of this limestone is reddish purple and orients to the layer parallel to bedding plane. The other one is in the alternation of limestone (100-200 cm.) with black shale (10-20 cm.). This limestone has laminated partly, on the upper surface, trace fossil of creeping animal are observed. Expected microenvironments are lagoonal swamp with some times invasion of fresh water. This groups originated from fresh water environments. So, according to explosive evolutional trend, they may extend to marine environments. It is important to collect more samples and precise taxonomy.

Fish fossils are mostly the surface of body, hard diamond scales. They are lacking the skull, according to the characteristics of fish scale, fish fossils are belonged to Osteichthyes (Class), Chondrostei (Superorder), Palaeochondrostei (Superorder), Paleonisciforms (Order). These group is characterized by the characteristic “Ganoid” scale. Like these fish fossil had been refered from China (Lu and Ma,1973)

Acknowledgement

This report will be succeeded if it derive without who are support to me as follows Dr. Yoshio Sato who is advisor that support about data and instructions when I make mistake. Mr. Somchai Nakapadungrat who is co-advisor that instructs when I have some problems. Computer's room of department of geology where is use to upload about previous report. Moreover , in fieldwork , I had gotten the support from my friends who go to fieldwork with me. So , I have to thank to these people in reference to what has been said.

Auekamon Phattharakullapong

Reseacher

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Chapter 3 : Results and interpretations

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CHAPTER 1

INTRODUCTION

INTRODUCTION

During 2009 ‘s fieldwork II at Amphur Bung Sam Pan, Changwat Phetchabun we found many fish fossils in Phetchabun’s limestone. So I am interested to study.

Accordingly, abundant fragments of Chondrosteans in Osteichthyes can be collected with only one completed specimen. The beginning of Chondrosteans in Paleozoic have the important characteristics adaptive radiation of the bone fish took place in 3 major steps. Representatives in the hypothesis of the three major bony fish groups show stage in evolution to ward thinner scales, more symmetrical tail, toward movement of pelvic fins, and shortening of the dentary. Taxonomical description of Permian fish fossil is the first record in Thailand.

Fish fossil which found in Phetchabun’s limestone deposit parallel with crinoids limestone bed so so it show that fish fossils are transported to accumulate with crinoids. Fish fossil can show about paleoenvironment where it had been lived and its characteristics can also estimate about shape of fish fossil.

Literature Review

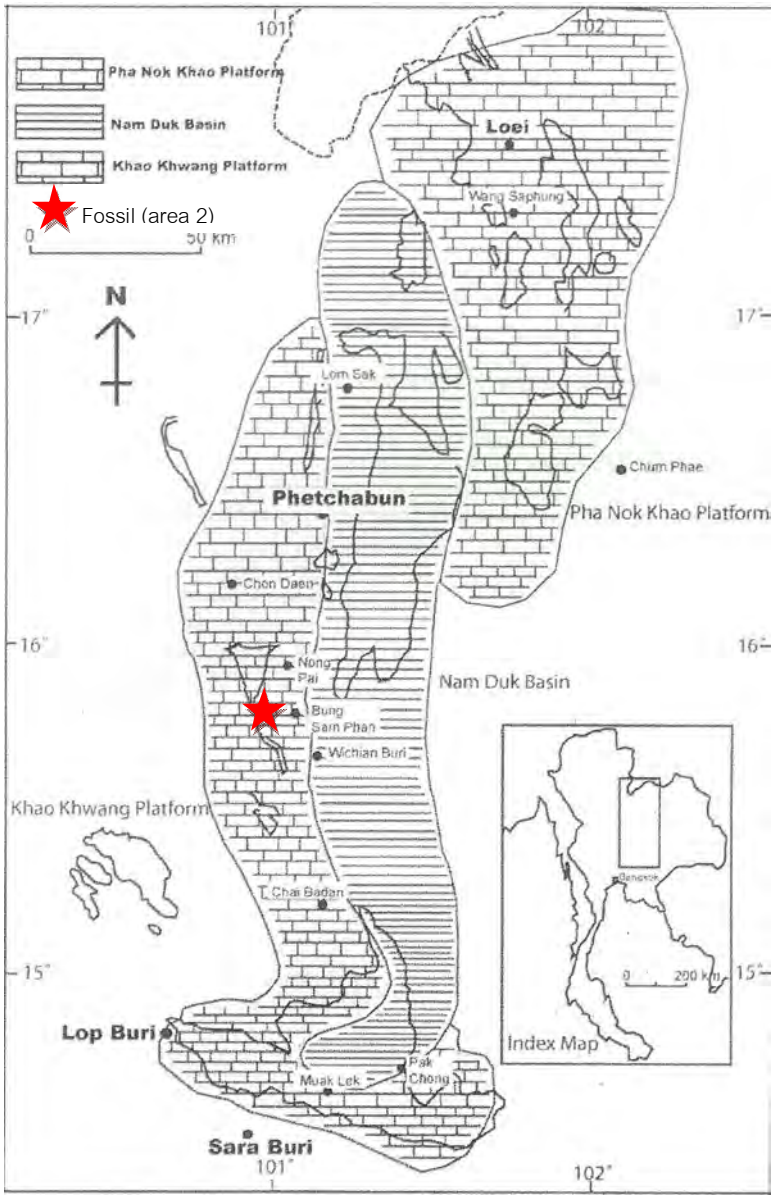
Fontaine *et. al.,* (2000) studied about paleoenvironment of Permian limestone in central Thailand, the Permian is represented in castellated limestone hills, which are widely distributed from Saraburi to Phetchabun and Uthai Thani. They are rich in algae and fusulinaceans, which have been actively studied. About 50 km south-southwest of Phetchabun in the Nong Phai area at Khlong Wang Ang, fragments of fossil plants were collected from black shale.

		Penin-sular	West	NW of Chiang Mai	North of Chiang Mai	North	Central	Nam Duk Basin	North-east	Si Racha, Klaeng	South of Sa Kaeo	Near Cambodia
Lopingian	Changh-singian			Limestone pre-dominant from the base to the top of Permian	Probably continuous deposition, of siliceous rocks with radiolarians	Area north of Lampang	Saraburi to Uthai Thani and Phet-chabun area	Shale	Shale, sandstone with plants	Limestone	Chert with Middle-Upper Permian radiolarians, some Limestones	
	Wuchia-pingian	Rat Buri Limestone								Shale		Limestone
Guadalupian	Midian		A few localities			Doi Pha Buang		Khao Lam Yai	Codono-fusiella			Volcanic rocks
	Murga-bian									Limestone and shale		
	Kuber-gandian					Doi Pha Toob, Doi Pha Sing		Shale, chert, siltstone, sandstone	Nam Maholan Fm.			
Cisuralian	Kungurian						Khao Som-Phot, South of Phet-chabun					
	Artinskian											
	Sakmarian	Phuket Group				Kiu Lom dam						
	Asselian											

(Fontaine et.al.,2000) Table 1 : Summary of the data on the Permian of Thailand.

Phetchabun

Chitnarin *et.al.,* (2005) studied a paleogeographic unit about Bueng Sam Pan district where is my study areas located In central Thailand, three paleogeographic units are recognized from West to East:Khao Khwang Platform, Num Duk Basin and Pha Nok Khao Platform. And Bueng Sam Pan district on the Khao Khwang Platform of Wielchowsky and Young (1985) during Early to Middle Permian (Asselian to Capitanian).



A nonrestored paleogeographic map of Permian environment in northeast Thailand (modified from Chonglakmani and Fontaine , 1990)

Becker *et. al.,* (2002) studied about Oseithyes and paleoenvironment deposits. In Meade Country, South Dakota, USA, contains an osteichthyan assemblage indicative of transitional to marine shoreface deposits. Fairpoint osteichthyans are members of families that survive the Cretaceous – Paleocene boundary extinction event.

Theory

The sedimentological study of limestone and taxonomical analysis of Osteichthyes can tell micropaleoenvironments in Phetchabun.

Objectives

1. To reconstruct the paleoenvironments by using the results of sedimentological facies analysis and taxonomical analysis of Osteichthyes.

2. To reconstruct the taphonomy of Osteichthyes.

Scope of work

To study fish fossils in limestones at Amphur Bueng Sam Pan (fig.1-2) , Changwat Phetchabun (fig.1-1). Study and prepare geologic map of study area and taking the sample for studying what kind of fish fossil in the laboratory. To reconstruct paleoenvironments where this living by used to lived using both paleontology and sedimentology.

Study area

Study area at Phetchabun province

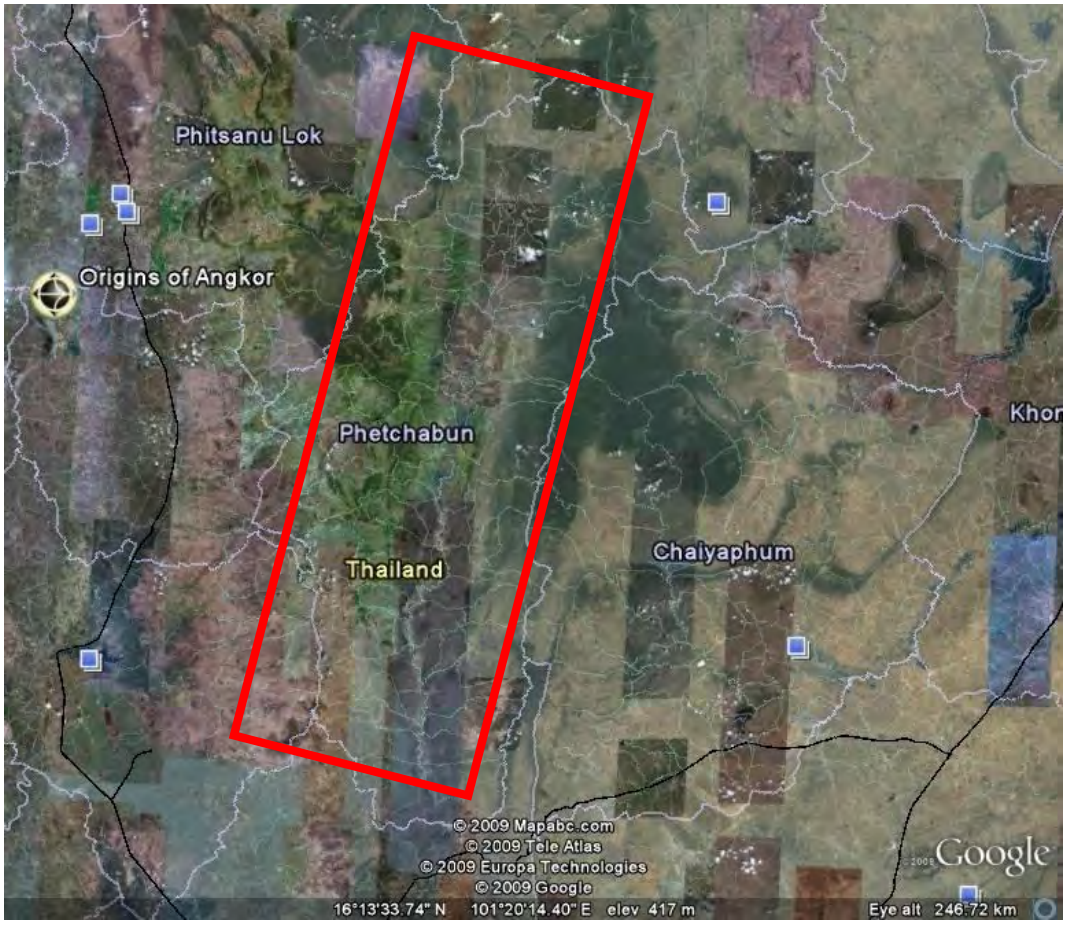


Fig.1-1 : Image of Phetchabun province satellite.

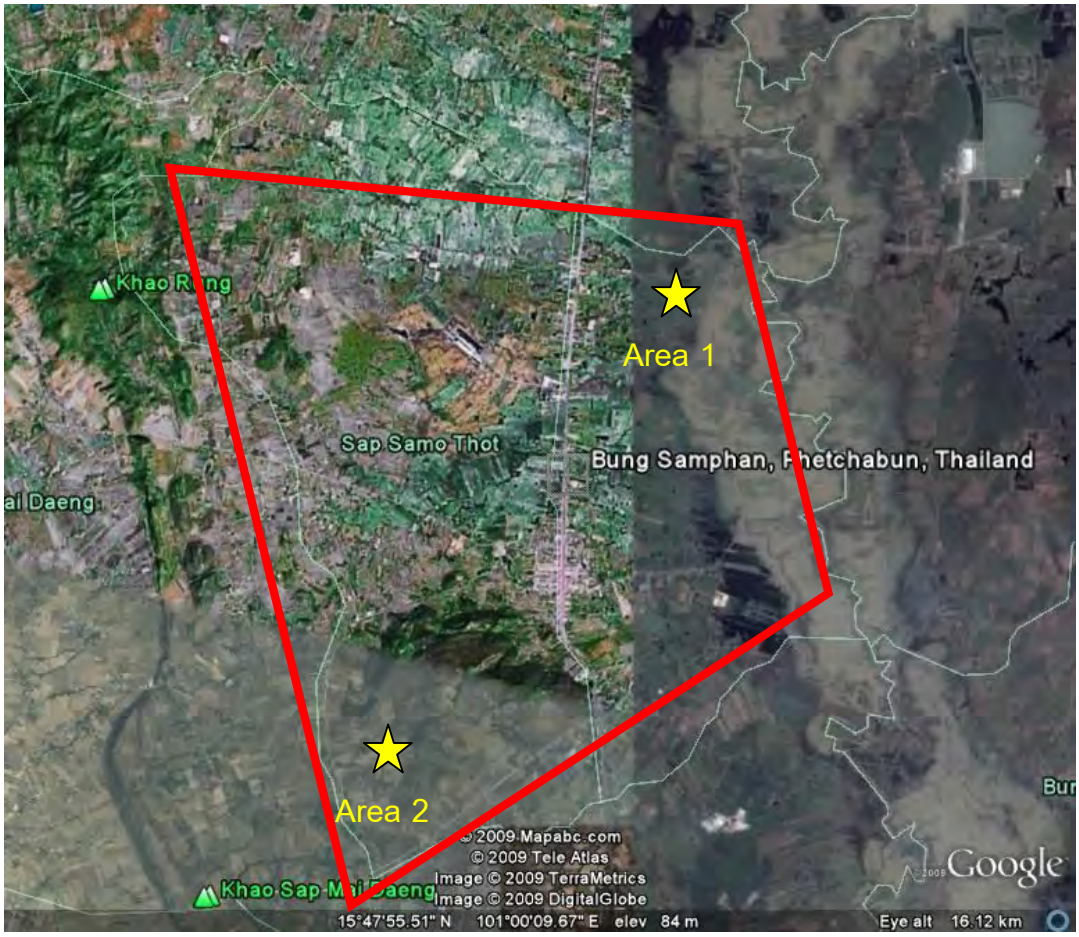


Fig.1-2 : Bueng sam pan district picture from satellite.

(study area in Bueng SamPan district)

★ Study area

Output

1. Paleomicroenvironments of limestone.
2. Precise taxonomy of Osteichthyes.

Fig.1-3 : Morphology of high land flat , fossils locality

Fig.1-4 : Fossils locality of crinoids hill (area 2)

CHAPTER 2

METHODOLOGY

DATA ACQUISITION AND ANALYSIS

METHODOLOGY

1. Study data of research

1.1 Search for data previous works related to this study

1.2 Compile all data.

2. Field work study

2.1 Geomorphological and geological study.

I compiled geomorphological map (fig.2-1) by using contour lines for distinguishing height for showing high land and flat area. Each geomorphological elements are identified in the course of fieldwork. Then , study and compile reported geologic maps (fig.2-3 , fig.2-5) of fieldwork II by using maps from area 4 to area 7, and take these maps to compare again for studying what is type of rock that found fish fossils.

2.2 Collection of fish fossils.

Collected represents of fish fossils (fig.3-1) from limestone's outcrop (fig.2-6 , fig.2-7) for studying taxonomy (fig.3-2) and identified its species for taphonomy.

2.3 collection samples for study in laboratory.

Samples that had been kept from field work are both fish fossil and rock samples ; for studying about paleoenvironment by studying under the microscope what's type of rock

3. Laboratory work

3.1 Taxonomy analysis of Osteichthyes.

Study about all of parts of fish fossils that can been shown about characteristics. Espectually , scale because there are 3 types of fossils in Permian so each type has different scale. By studying from catalog of fish fossils (fig.3-5). Moreover , bone of fish (fig.3-3) can show top and bottom of fish's body.

3.2 Taphonomy analysis of Osteichthyes.

Taphonomy is the study of name. So , taxonomy analysis will make to know about name of fish fossil.

3.3 Making thin section for studying about type of rock.

To study type of rocks from thin sections (fig.3-6 , fig.5-5 , fig.5-6) for estimating about its paleoenvironments that these fish fossils had able to lived.

4. Results and interpretations

Take all data acquisition to analysis in order to getting results. Then , take the results to interpret for discussion and conclusion.

5. Discussion and conclusion

    5.1 About the paleoenvironment in the study area.

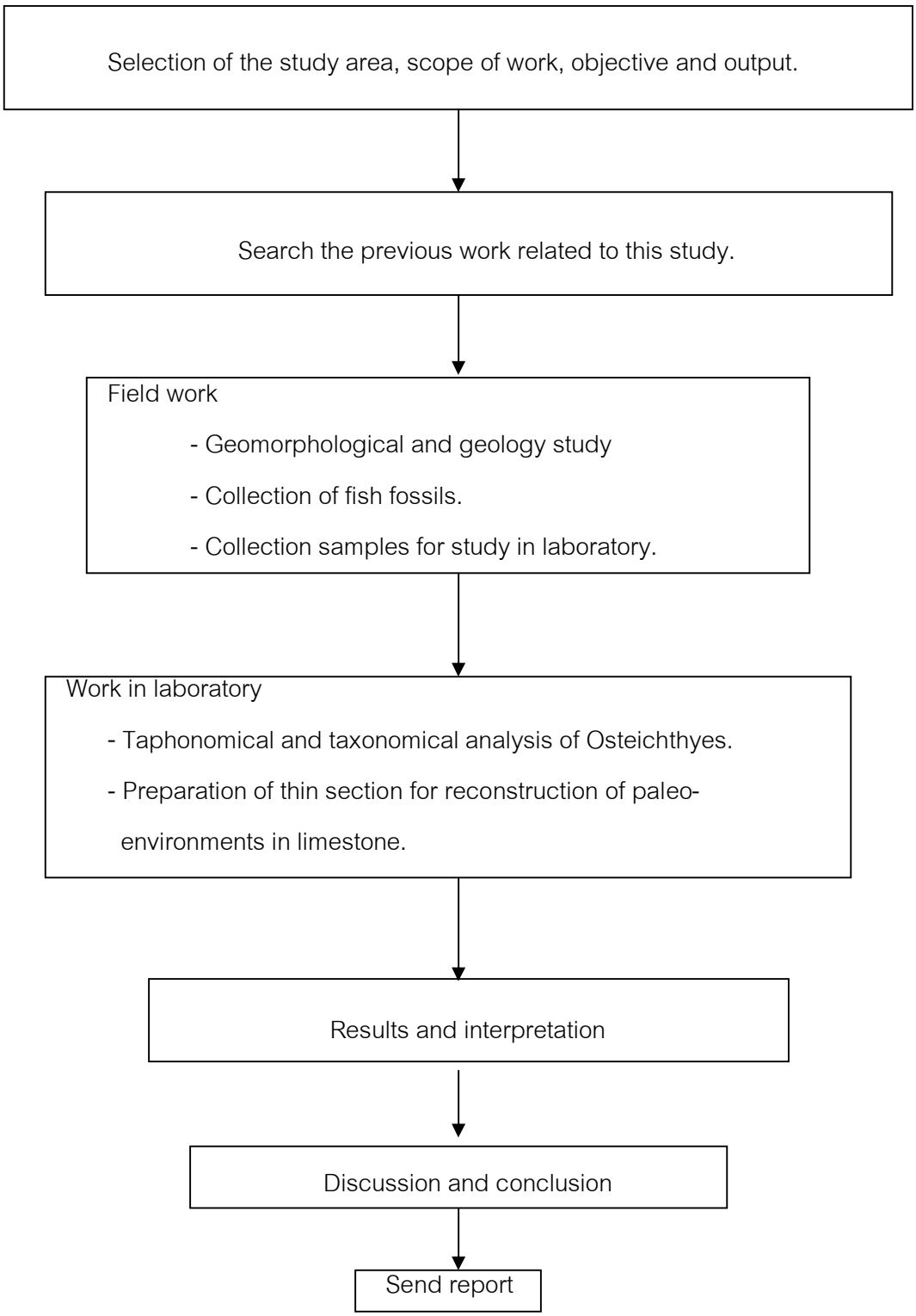
    5.2 About kind and the name of Osteichthyes from taphonomy and taxonomy analysis.

    5.3 About geologic age of limestone that found Osteichthyes.

6. Report writing

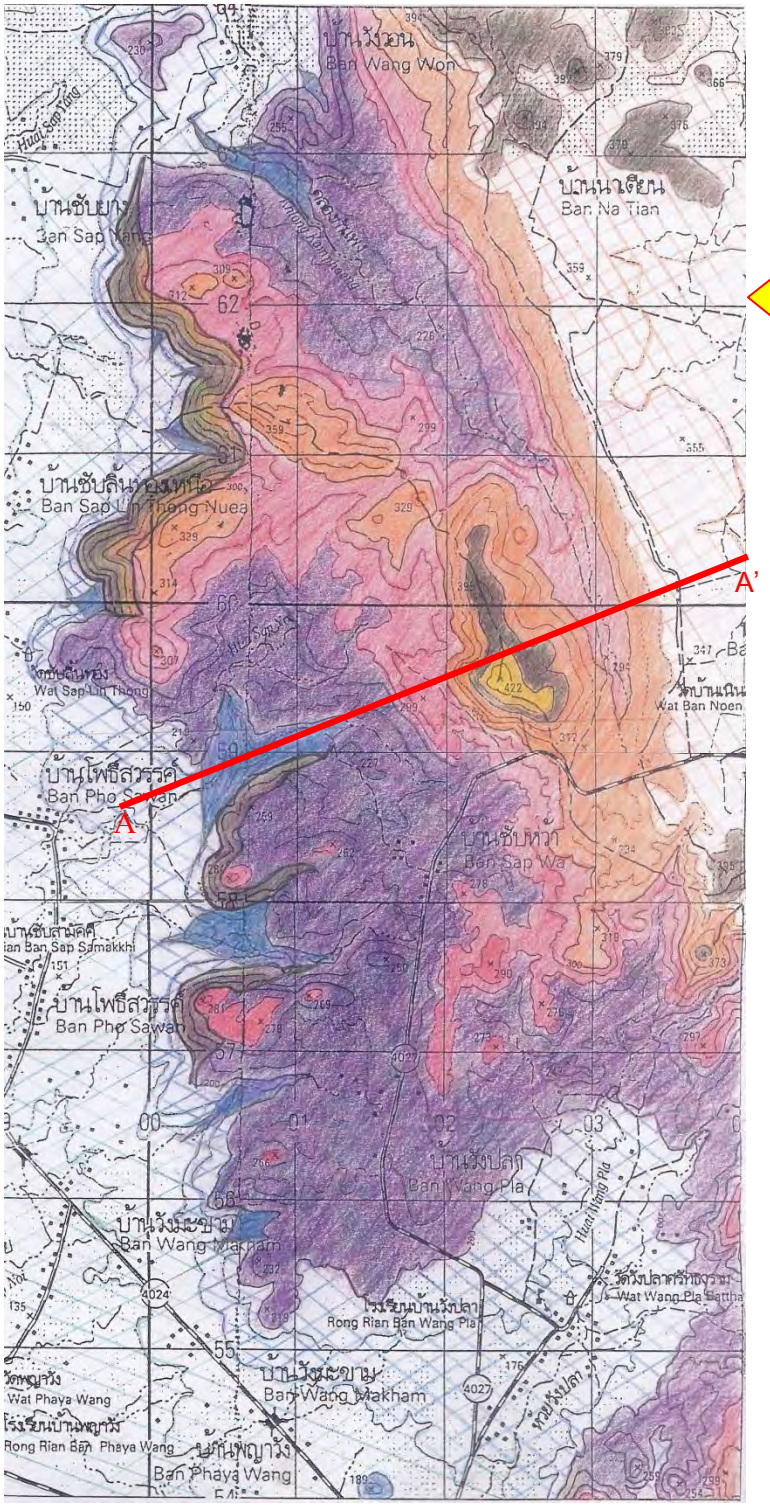
7. Send report

Methodology (flow chart)



DATA ACQUISITION AND ANALYSIS

Geomorphologic map shows high land flat area



High flat of area1.where found fish fossils.

fig.2-1 : Morphological map of study area

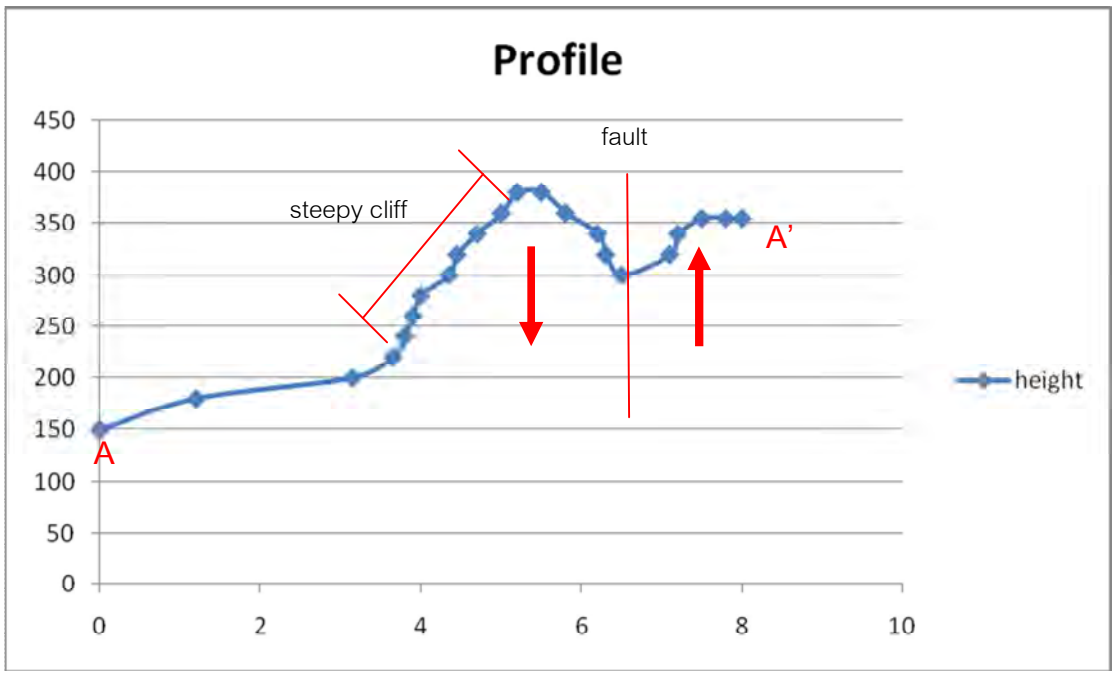


Fig.2-2 : Profile of study area in morphological map.

Legend

400-450 m.

350-400 m.

300-350 m.

250-300 m.

200-250 m.

150-200 m.

High land flat

Low land flat

Low land flat

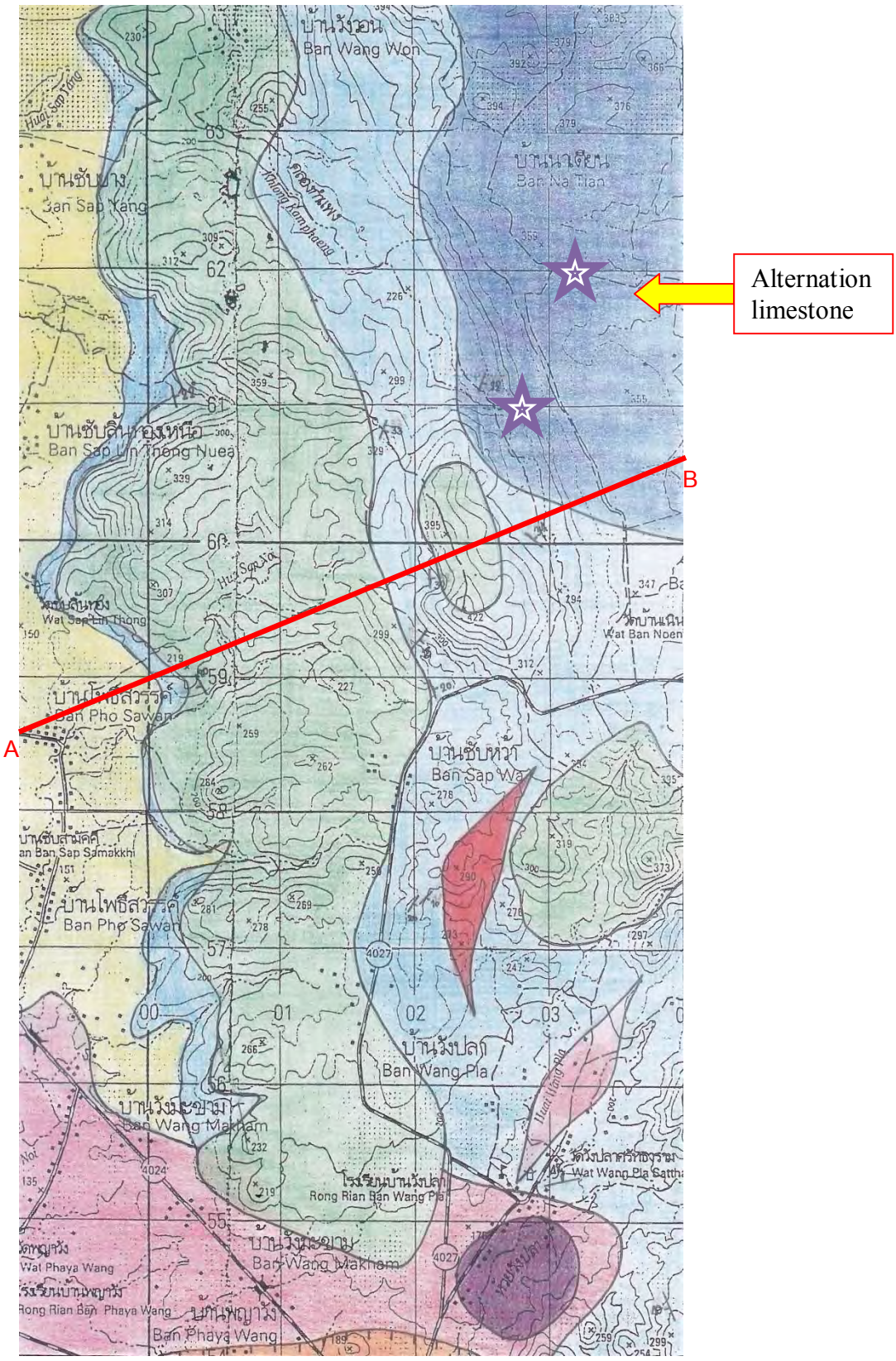


Fig.2-3 : geologic map of area 1.

(Geologic map shows type of rocks that found fish fossils at high land flat area (area 1.))

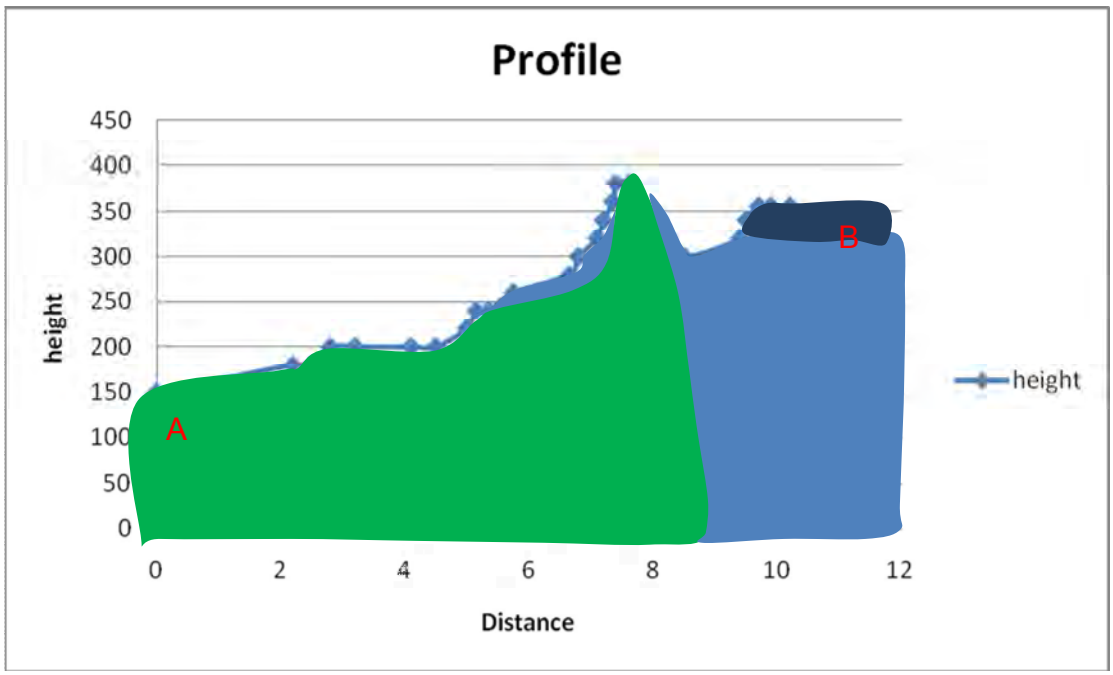


Fig.2-4 : Profile of study area in geologic map.

Legend

- Limestone
- Pure Limestone
- Diorite
- Basaltic Tuff
- Andesite
- Quartz-Felspar Porphyry
- Rhyolite
- Quarternary Sediment
- Fossils locality

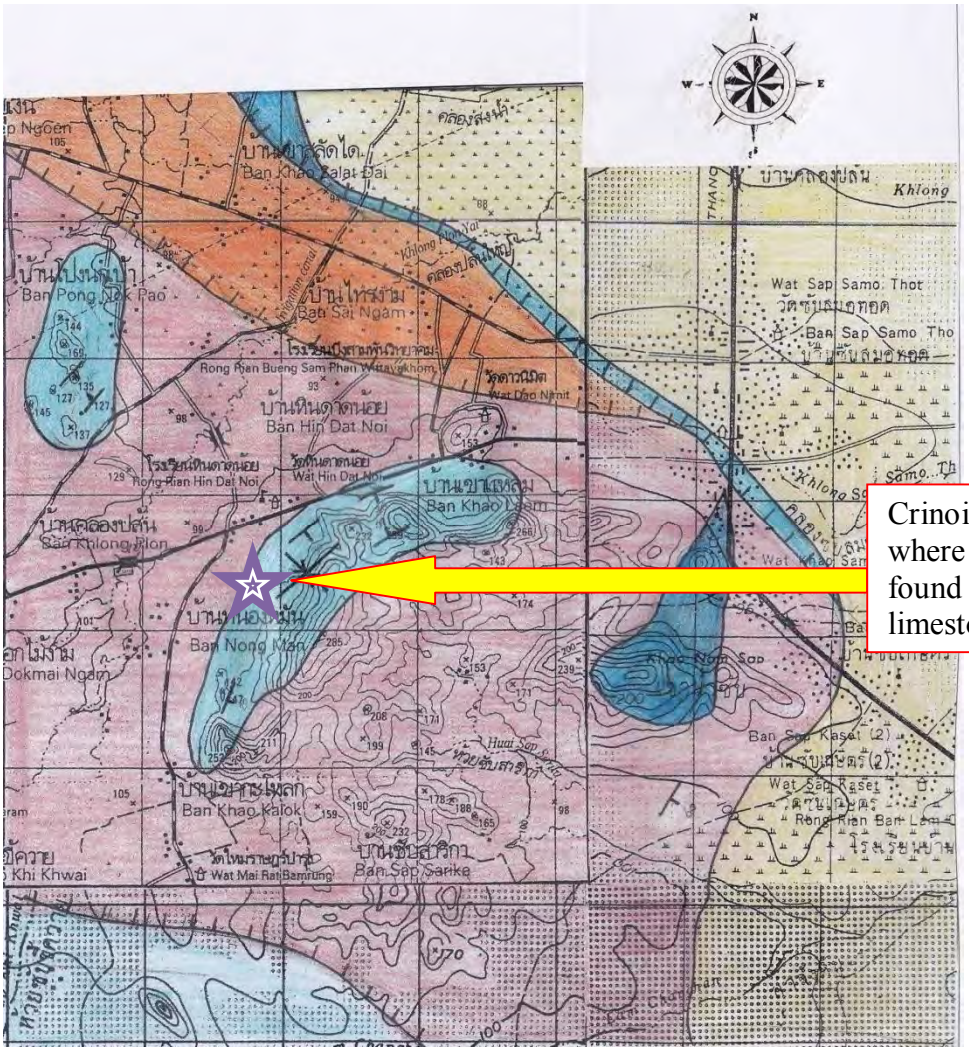


Fig.2-5 : Geologic map of area 2. (same legend fig. 2-2)

(Geologic map shows type of rocks that found fish fossil at Crinoid hill area (area 2.))

☆ Fossil locality

Due to fish fossils had found in two area such as area 1 and area 2. Area 1 is high flat where is the north of Phetchabun. Area 2 is hill of crinoid where is the southwest of Phetchabun. The rocks of both areas have difference each other because area 1 is alternation limestone (fig.2-6) and area 2 is tuffaceous limestone (fig.2-7) but the both areas were found the same species of fish fossils.

Fig.2-6 : Bedding of alternation limestone and mudstone.

Bedding of alternation limestone (area 1; high land flat) where was found fish fossils but they don't complete and difficult to study about taxonomy because just found only fragments of fish fossils such as its tooth in surface and bones. Therefore , fragments of fish fossils in this area can't apt to study about taxonomy of fish fossils and around this area be found crinoid bed that same in area 2. Moreover , trace fossils of creeping animal are also observed in this limestone (fig.5-1).

Fig.2-7 : Bedding of tuffaceous limestone.

Fish fossil had found inside crinoids bed at area 2. Rock type is tuffaceous limestone. Therefore , fish fossil was found in this tuffaceous limestone is more clearly appear about its characteristics so I had taken fish fossil from tuffaceous limestone (area 2.) be representation for studying taxonomy of fish fossil.

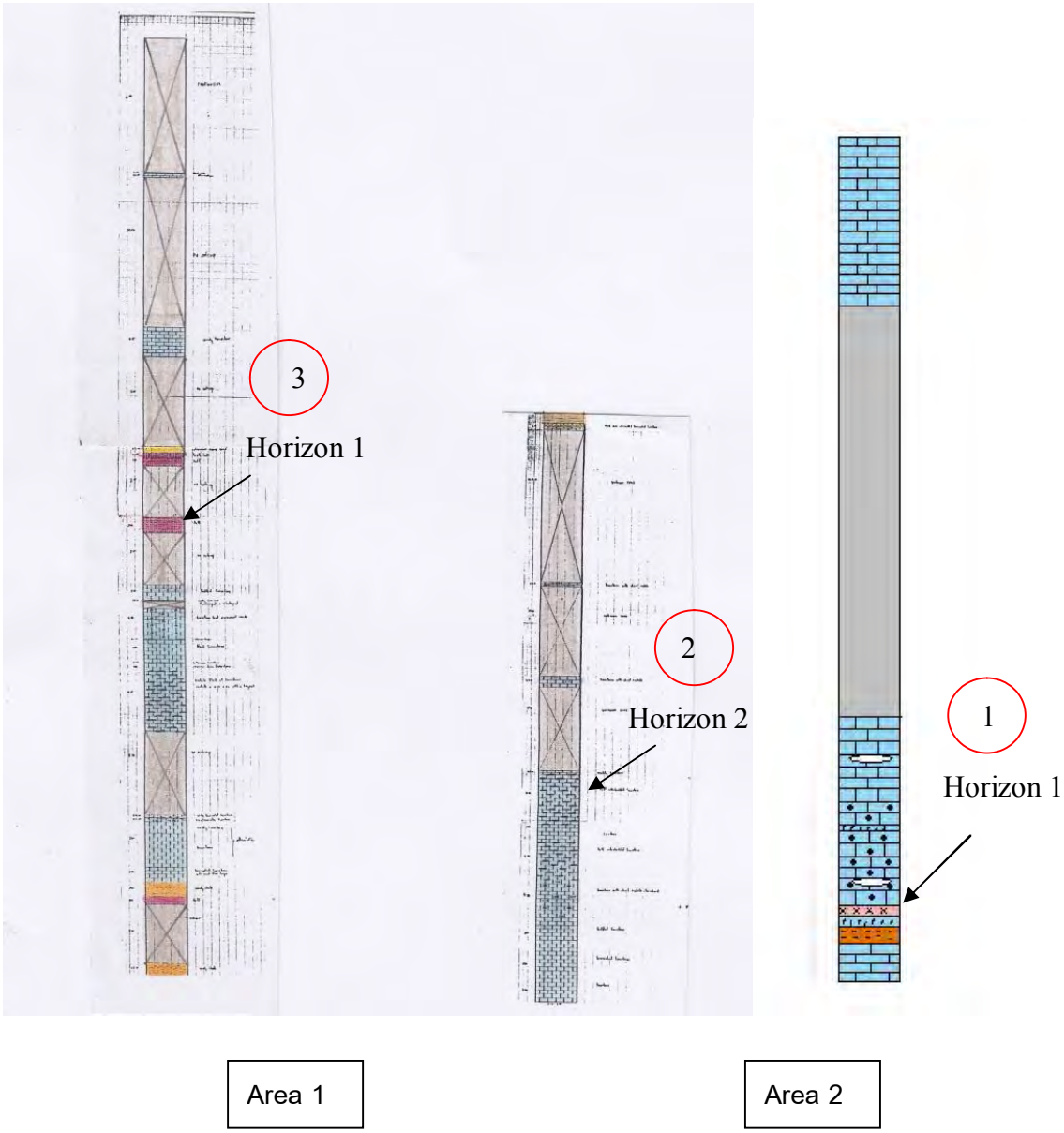


Fig.2-8 : Relation of columna sections between area 1 and area 2.

Totally , fossil locality are three. This is both columna section in are high land flat (area 1; two horizon)) and crinoid hill (area 2 ; one horizon). By high land flat was found fish fossils 2 horizons are horizon 1 (tuffaceous limestone) and horizon 2 (alternation limestone) so the both horizons were found the same species fish fossils. In area 2, was found fish fossil inside horizon 1 (tuffaceous limestone). Due to the both areas can be found the same species fish fossils and found crinoid bed , so can take representation of fish fossil from area 2 for studying , through the represent from area 2 is more complete than area 1. And upper horizon 1 has brachiopods that is key bed of middle Permian. (Kobkhaew *et,al.,*2008)

CHAPTER 3

RESULTS AND INTERPRETATIONS

Stratigraphy of study areas

1. My study areas have two areas. The first area is high land flat area (area 1). It consist s of 8 types of rock follow the stratigraphic table below. So limestone ; in this area almost limestone have pale gray is weathered color , dark gray is fresh color and lots of fossils inside such as gastropod , ammonoid (fig.5-4) , brachiopod , bryozoans (fig.5-3) etc. Moreover ,also has tuff is thin layer with limestone.

Stratigraphical table (area 1)

No.	Rock	Relationship
1	Limestone	oldest ↑
2	Pure limestone	
3	Diorite	youngest

2. The second area is crinoids hill (area 2). It consists of 3 types of rock follow the stratigraphic table below. So, fish fossil had found in tuffaceous limestone (area 2) and it's same species of area 1. And also found key bed of crinoids same area 1.

3. The second area also consists of stratigraphical position of horizon 1 is tuffaceous limestone and has key bed of crinoids. Horizon 2 is alternation limestone. Both horizons had found same species of fish fossils. Relationship between horizon 1 and horizon 2 can explain that horizon 2 is upper horizon 1 (fig. 2-8)

In field work , can found the rock that has relationship with fish fossil for reconstruction paleoenvironment are 3 types : tuffaceous limestone (fig. 5-6) , fossiliferous micrite (fig. 3-6) and laminated part of limestone (fig. 5-5).

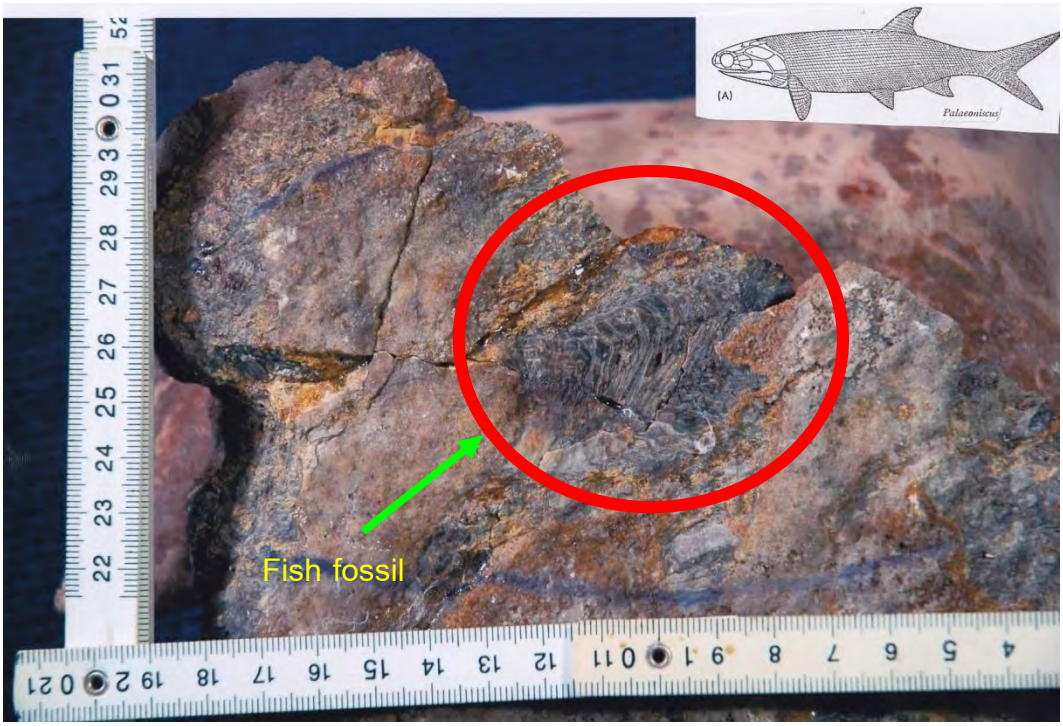


Fig.3-1 : representation of fish fossil.

The fish fossil found in tuffaceous limestone to shows some following characteristics. The representation of fish fossil in this picture shows some parts of body such as skin ; it's very sticky and strong because it can maintain to nowaday , fish bone; it's one of characteristics that easy to observertion because it can specify that fossil which found to be fish fossil and the most important part that can tell about its species is scale. Because scale is fragment of fish fossil that it remains to find in this representation and shape of scale look like diamond shape (fig.3-4) so it is called " Gonoid " scale.

From this representation , can also estimate about size and shape of fish fossil (fig.3-2) that found in tuffaceous limestone :

- length of body is 15.3 cm.
- width of body is 5 cm.
- size of scale ; wide 1.8 mm. and long 2 mm.

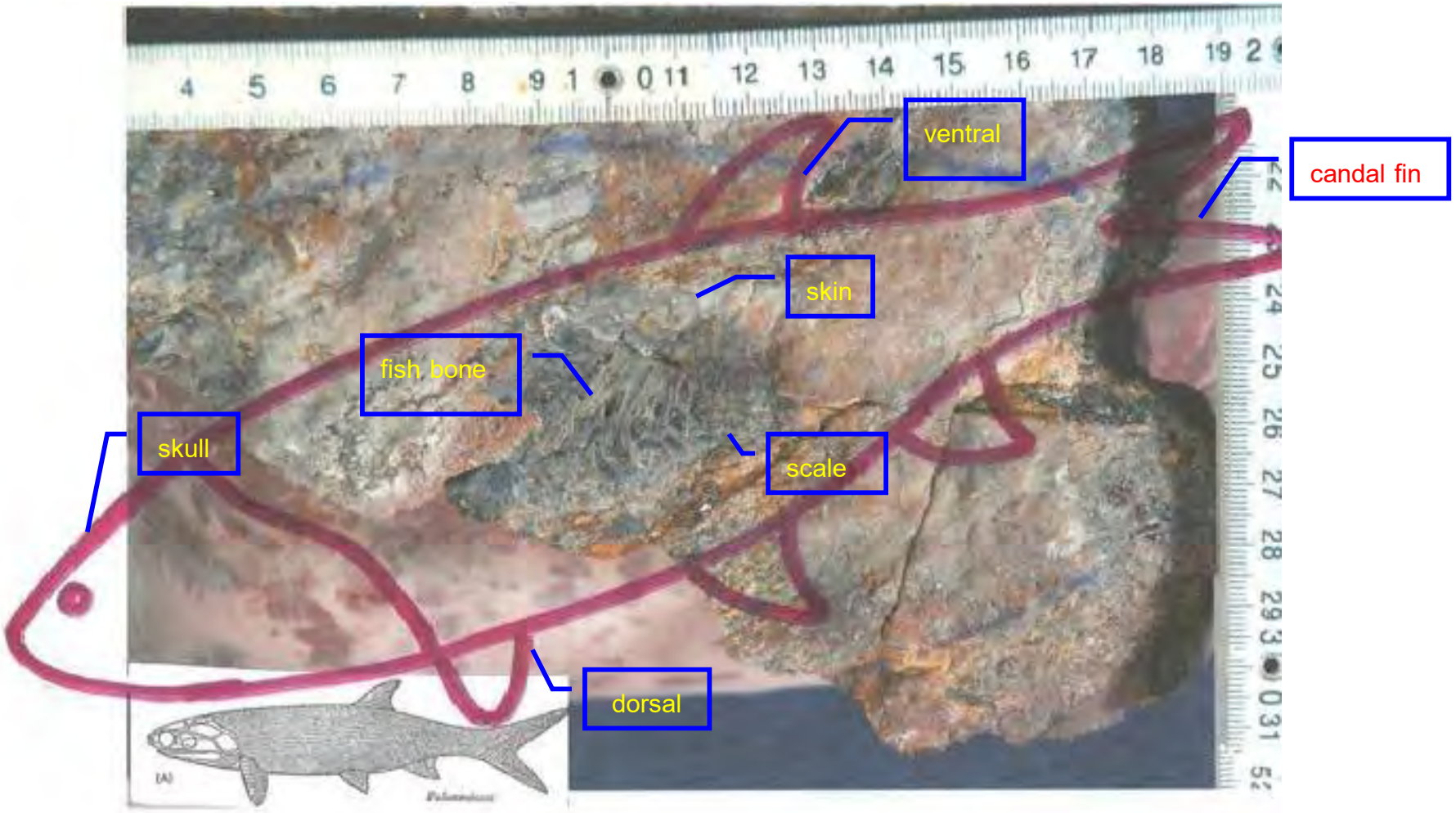


Fig.3-2 : Estimation of fish fossil

Fig.3-3 Bone of fish

Identification of bone parts

No.	Name of bone	Plate
1	nes 5	A
2	nes 6	B
3	nes 7	C
4	nes 8	D
5	nes 9	E
6	nes 10	F
7	nes 11	G
8	nes 12	H
9	nes 13	I
10	nes 14	J
11	nes 15	K

*from fig. 5-3 , * nes = upper fish bone (ventilate spire)

Fig.3-4 : Characteristic of fish fossil scale

Fish fossil which found in Phetchabun limestone has scales look like diamond shape has size; wide 1.8 mm. and long 2 mm. so it's be palaeosiscus species.

Fish fossils which found in Permian have 3 types (fig.3-5) are : Paleosiscus , Pholidoshorous and Dupe.

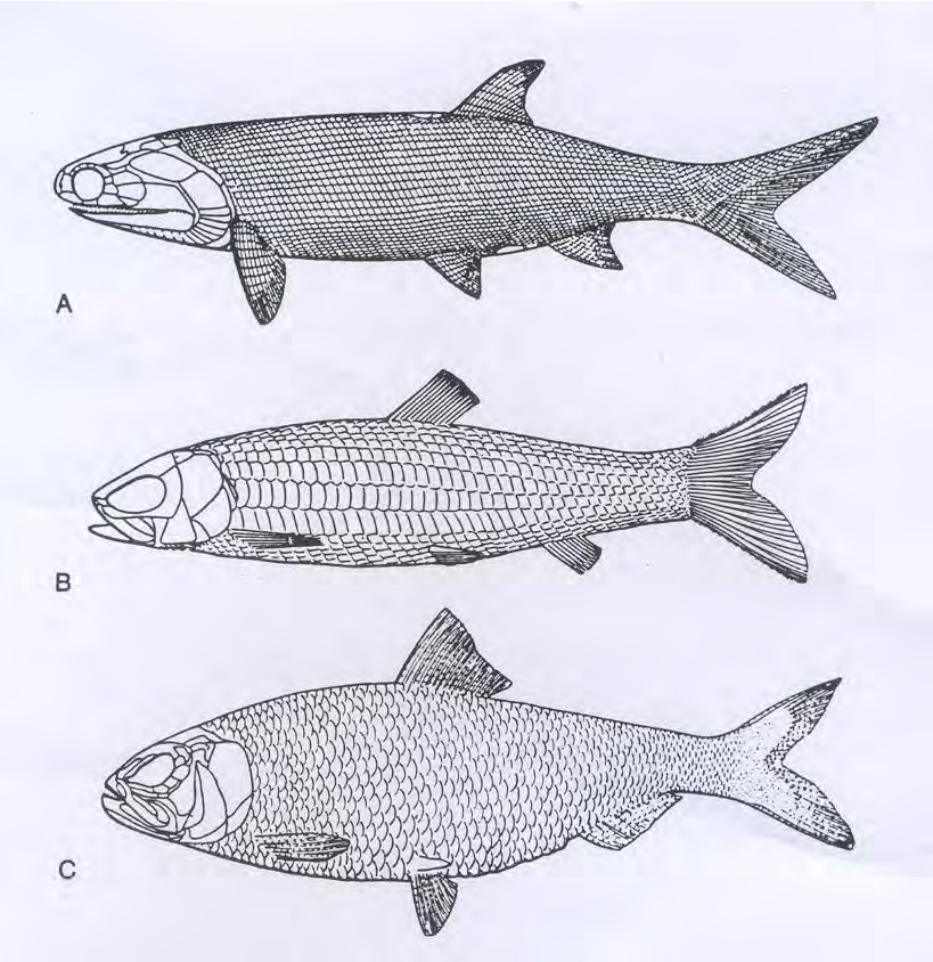
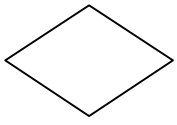
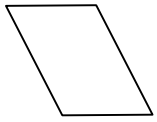
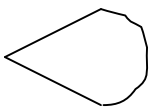


Fig.3-5 : Type of fish fossils in Permian.

This picture shows characteristics of each species of fish fossils in Permian so each species has different from each other because observe from scale shape are :

A. Palaeosiscus has scales look like diamond shape 

B. Pholidoshorous has scales look like 

C. Dupe has scale look like fan shape 

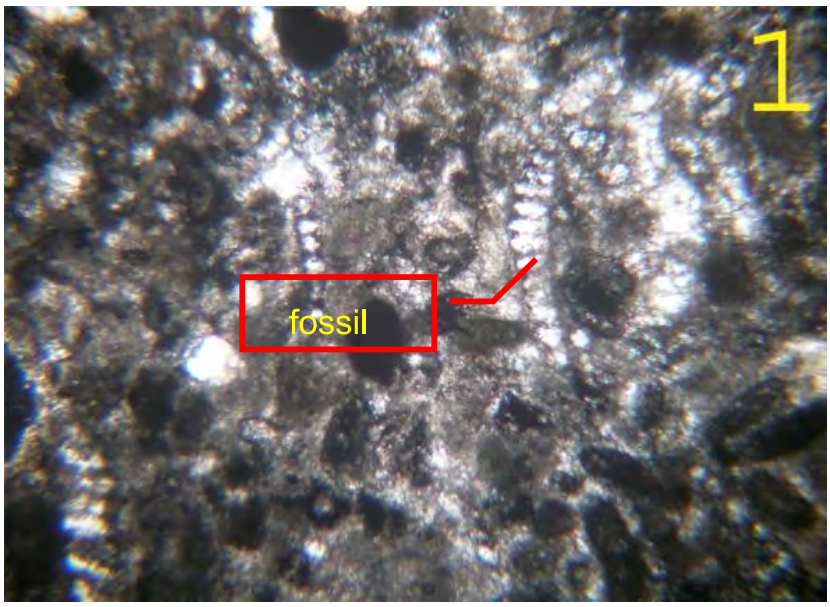


Fig.3-6 : Thin section picture under the microscope of fossiliferous micrite. (Picture of limestone).

Thin section of area 1 where found fish fossils inside horizon 2. From checking under the microscope , Folk's textural classification of carbonate sediments (fig.3-7) and carbonate depositional environment (fig.3-8) , respectively. It shows that it is fossiliferous micrite due to it consists grains of fossils about 1-10% and has lime mud to be matrix .

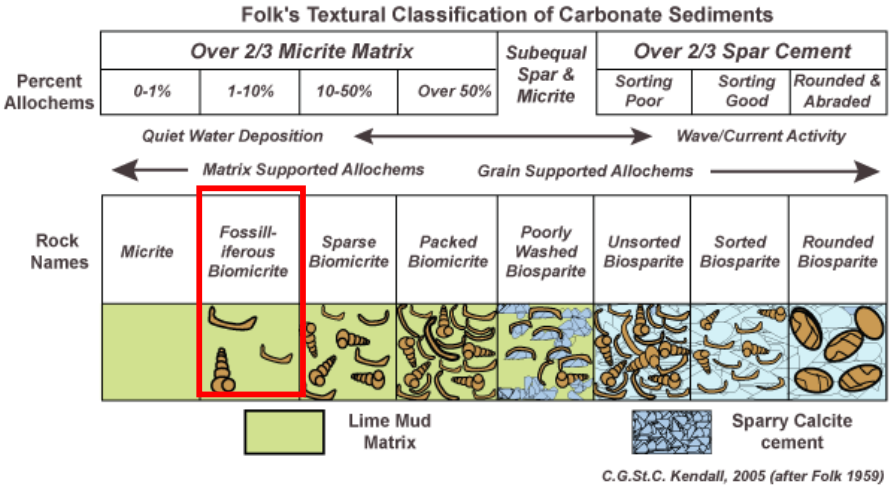


Fig.3-7 : classification sedimentary rocks of Folk.

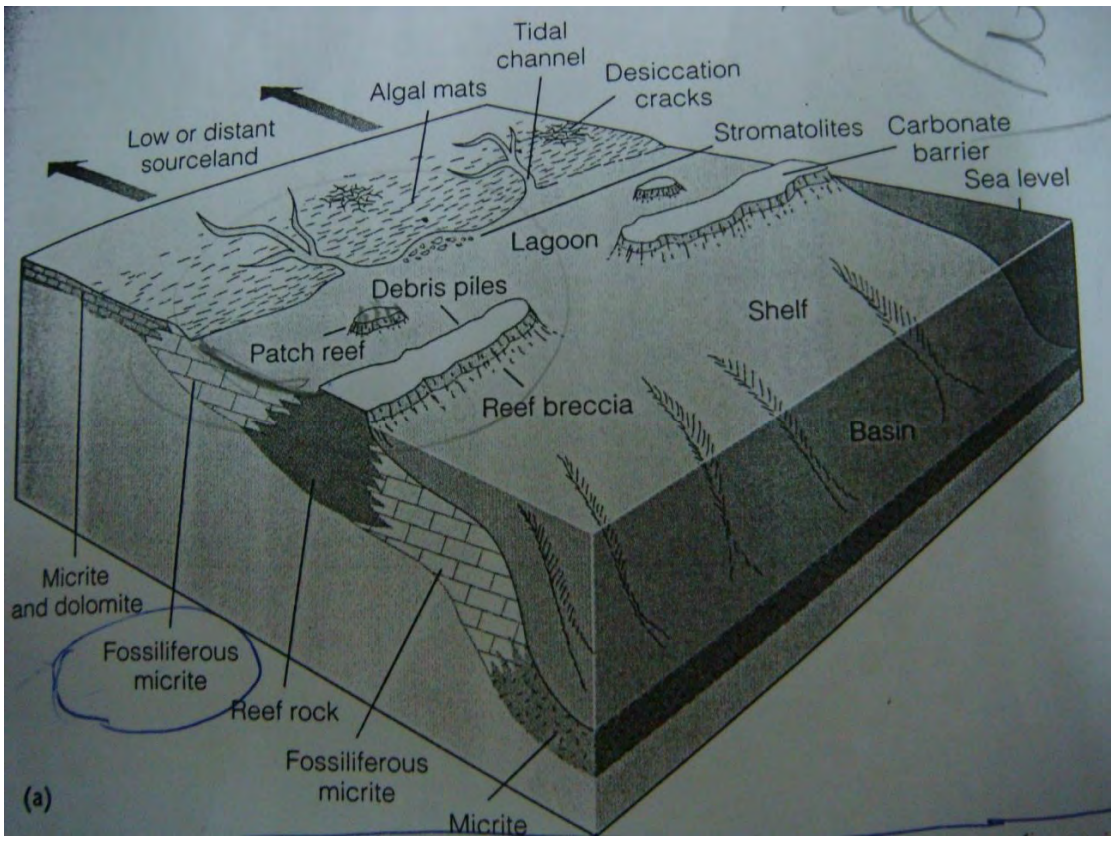


Fig. 3-8 : Carbonate depositional environment
(fossiliferous micrite).

From studying thin section and observation of sedimentary structure that found fish fossil under the microscope found that it's fossiliferous micrite. And then, take the thin section of fossiliferous micrite to check with carbonate deposition environment found that it's been in part of lagoon of barrier reef.

CHAPTER 4

DISCUSSION

CONCLUSION

DISCUSSION

1. From fieldwork , found that the lowest of columna section in area 1 is sandy shale. Then , alternation limestone (fig.5-2) is between tuffaceous limestone. So , fish fossils were found in tuffaceous limestone (horizon 1) and alternation limestone (horizon 2) that is upper tuffaceous limestone. The highest of this columna is black shale.

Columna of area 2 , the lowest is limestone , sandy shale is upper on limestone. Tuffaceous limestone (horizon1) is between limestone. The highest is pure limestone.

Both horizon 1 and horizon 2 , can correlate together because crinoids bed had found in both areas.

2. Fish in Permian have 3 types (fig.3-3) by the previous fish is Palaeosiscus ; has scale look like diamond shape. Next, it had evolved parts of body including its scales had changed is rhombus shape. Finally, its scales had changed is fan shape .

3. Lithology in area 1 is classificated to fossiliferous micrite (fig.3-5). Paleoenvironment that has relationship can be estimated lagoon on barrier reef (fig.3-7).

4. In area 2 , many fragments of crinoid had been accumulated. This indicate that the invader to the coral sea , at the same time , fish fossil had became the member of coral sea.

5. Limestone are separated in the field. So , the geological age of limestone is Permian but the deposition age may be Triassic. We need microfossil analysis (radiolaria) in the next stage.

6. In area 1 , found fragment of fish fossil inside alternation of limestone and mudstone. Fragment of fish fossil which found are skin , teeth and scale. Moreover , limestone had shown laminated part that indicate paleoenvironment to be shallow marine , back reef. Back reef shows transportation to be autochthonous.

In area 2 , found body of fish fossil and teeeh transported inside tuffaceous limestone with crinoids and many reef animals are accumulated. Therefore , fish fossils are transported and deposited with crinoids so the transportation to be allochthonous. Paleoenvironment is fore reef slope.

Area 1	Area 2
alternation of limestone and mudstone ; two horizon (horizon 1 and 2)	tuffaceous (andesite) limestone with crinoids
lagoon (barrier reef)	deeper , under the fore reef slope
very column , gradually sedimentation	so many reef animals are accumulated
skin , teeth , scale	body of fish , teeth transported
laminate indicates shallow marine , back reef	same energy as crinoids transportation
autochthonous	Allochthonous
↑ back reef , lagoonal environments	↑ fore reef slope

Table 2 : The kind of paleoenvironment for the sedimentation of fish

CONCLUSION

1. The fish fossils collected in Bueng Sampan area is identified to Palaeoniscus sp. According to the characteristies of ganoid scale.

2. The horizon yields the fish fossil from limestone in Bueng Sam Pan area are two horizons.

3. Paleoenvironments, where fossil fish had been lived is estimate to be lagoon of barrier reef.

4. Paleontologically, the fish fossils collects in Bueng Sam Pan area is very important to the phylogeny and explosive evolution of Osteichthyes at Middle Permian.

APPENDIX

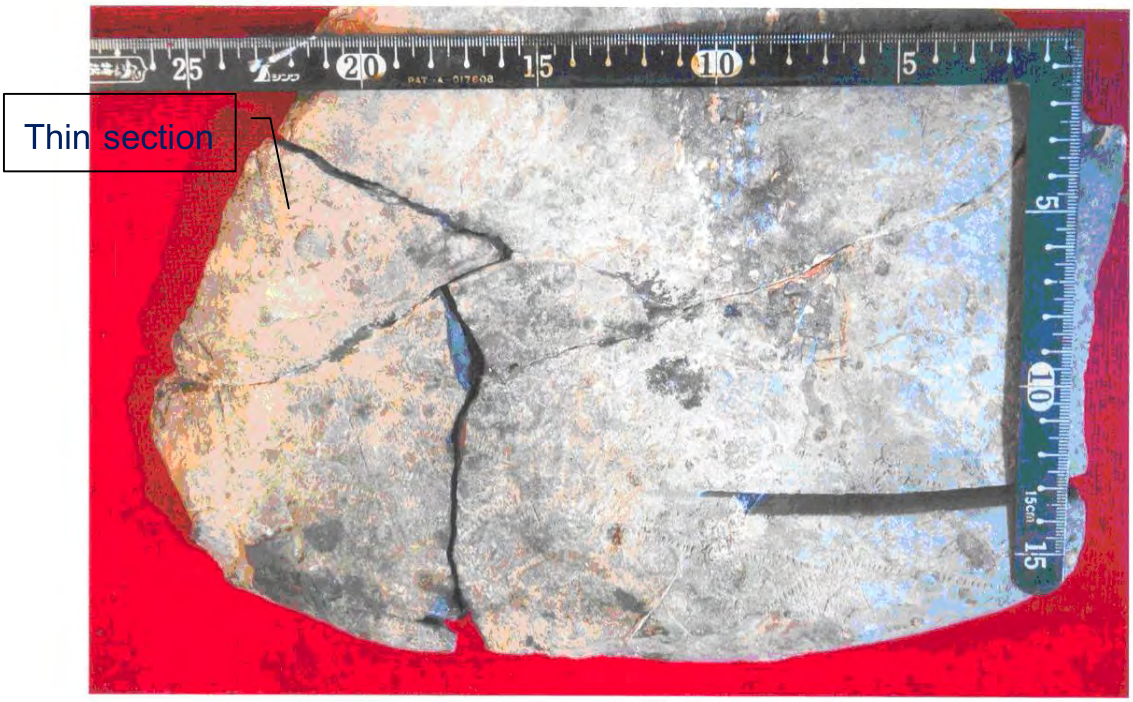


Fig.5-1 : Trace fossils of creeping animal are observed.

Fig.5-2 : Alternation limestone in area 1 (horizon 2)

(mud thin layer had been break out small mud block)

Fig.5-3 : Bryozoans that found in area 1.

Fig.5-4 : Ammoniod that found in area 1.

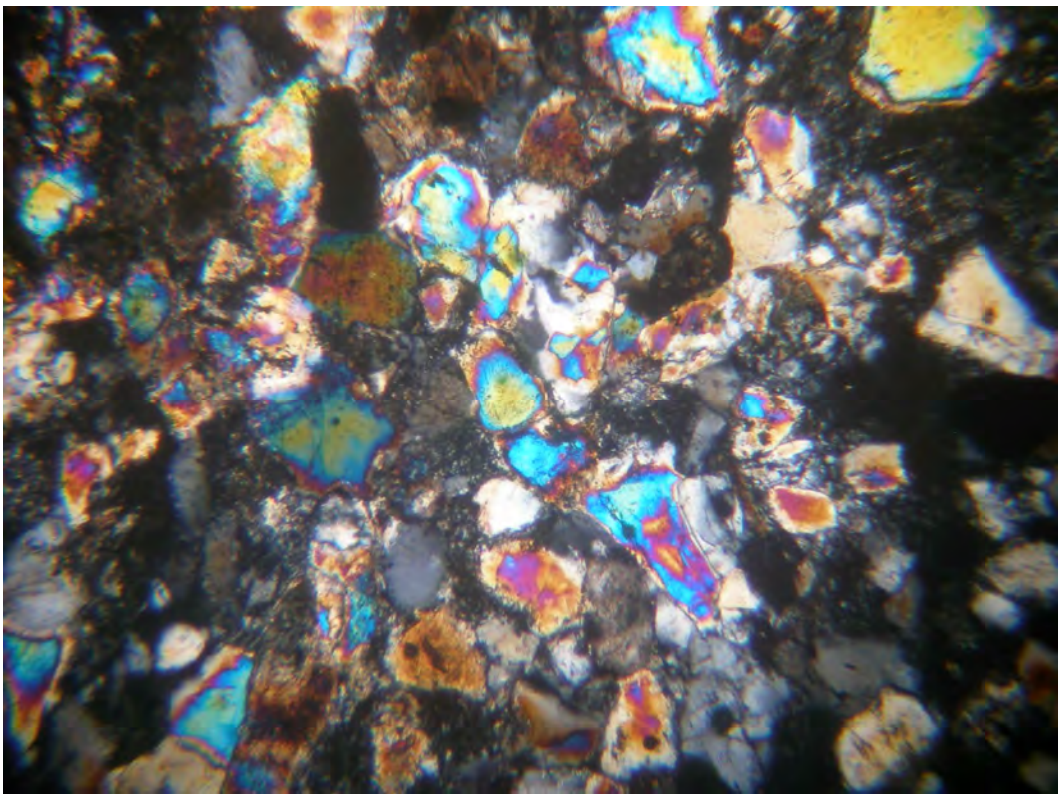


Fig.5-5 : Laminated part of limestone under the microscope.

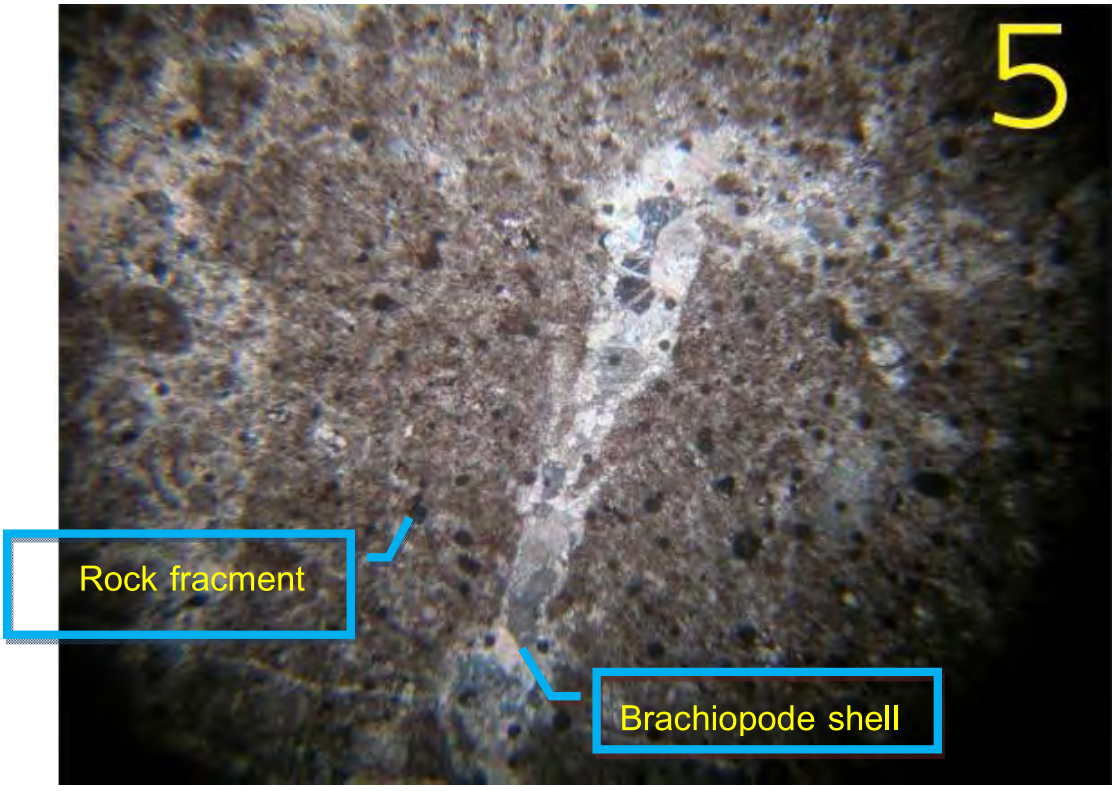


Fig.5-6 : Tuffaceous limestone under the microscope(area 2).

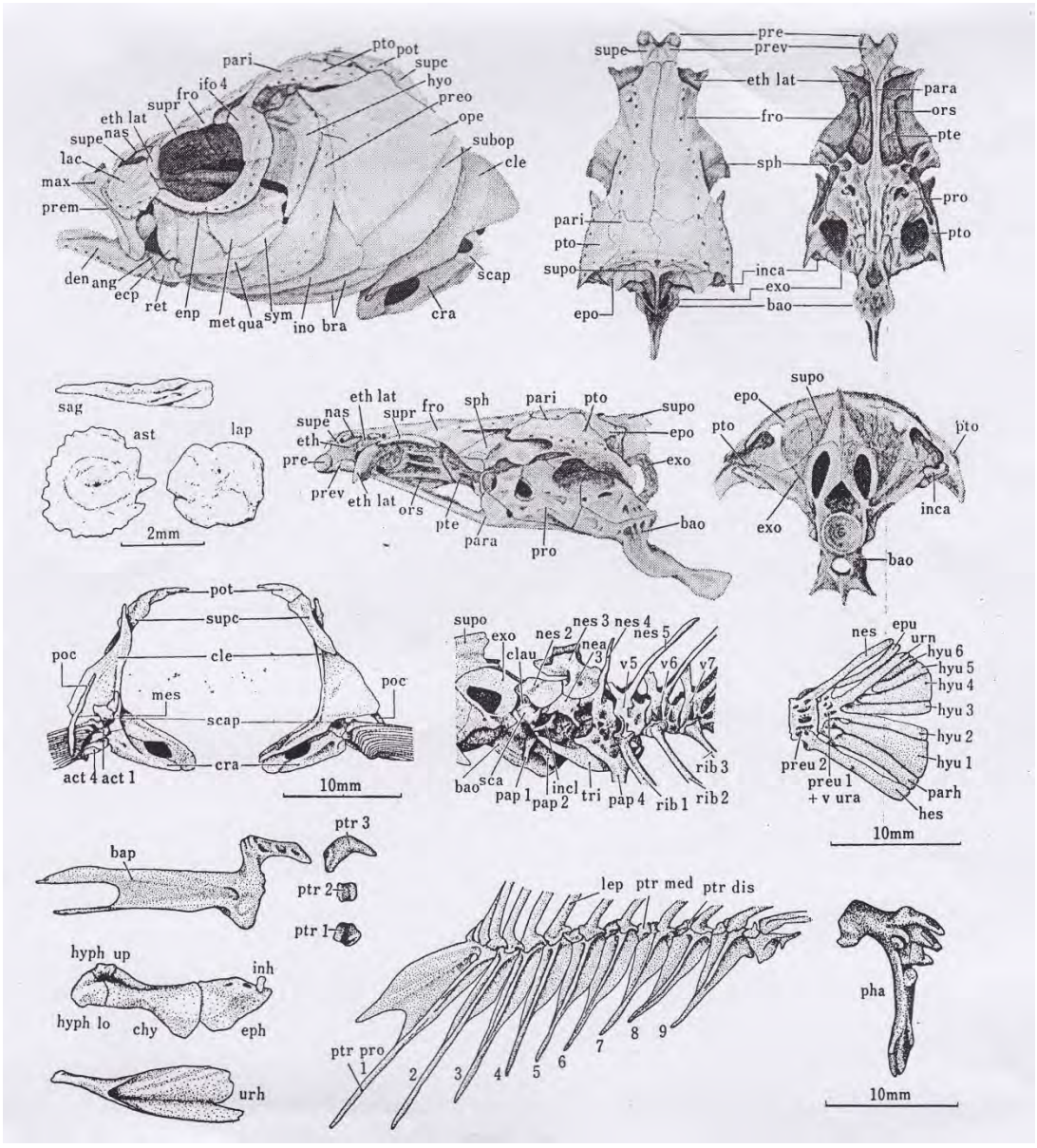


Fig.5-7 : Name of bone fish

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