GEOLOGY BEYOND FRONTIER

THE MALAYSIA-THAILAND BORDER JOINT GEOLOGICAL SURVEY COMMITTEE

STRATIGRAPHIC CORRELATION OF THE SINGA-KHUAN KLANG FORMATIONS

Malaysian-Thai Working Group

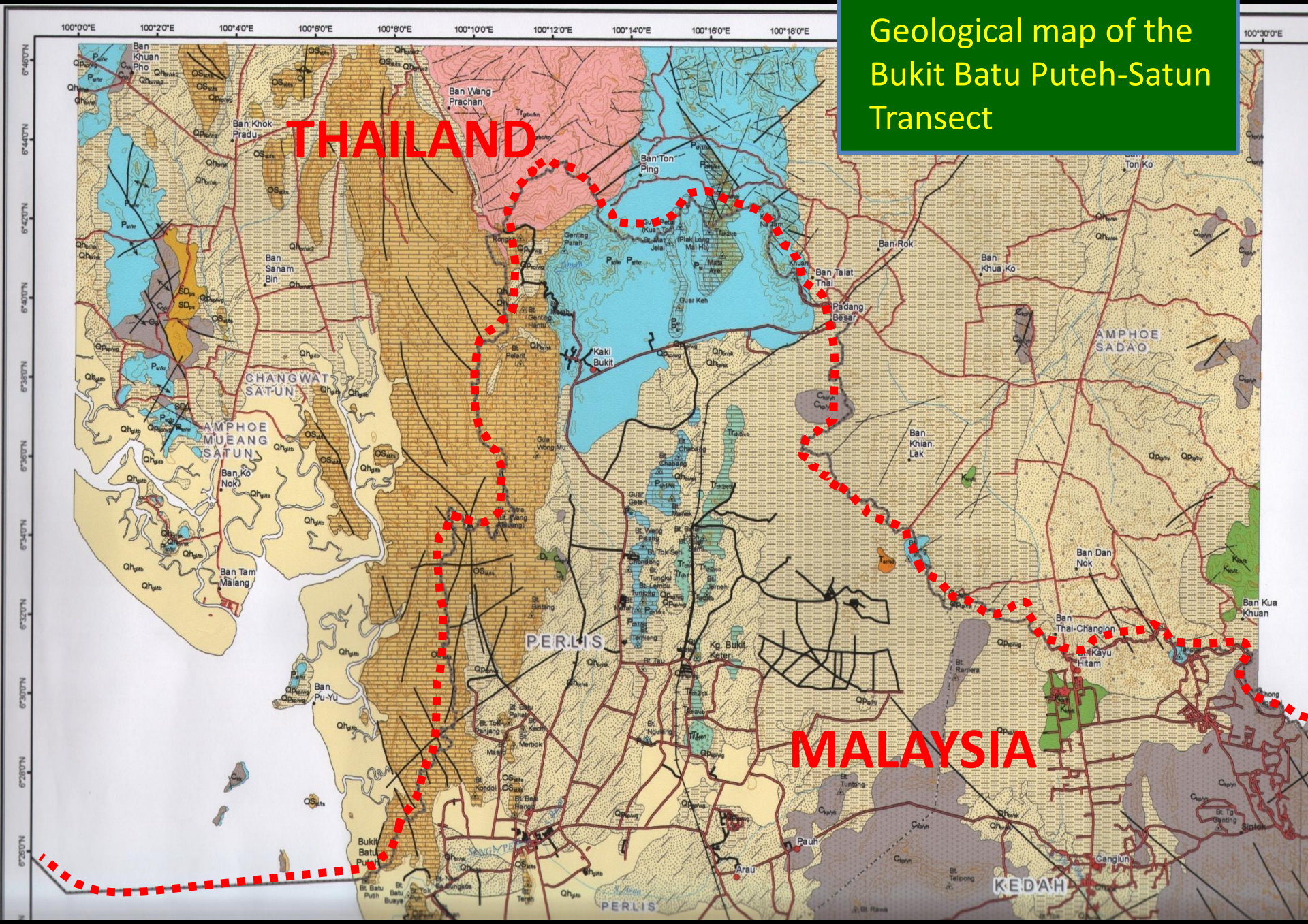
OUTLINE

- Introduction
- Correlation
- Distribution
- Type section
- Reference section
- Age
- Depositional environment
- Conclusion

INTRODUCTION

WHY SINGA-KHUAN KLANG FORMATIONS?:

- Bukit Batu Putih-Satun Transect:
  - East of Kao Chin Granite: Kubang Pasu Formation correlated with the Yaha Formation
  - Western side: Khuan Klang Formation only exposed on the Thai side


Geological map of the Bukit Batu Puteh-Satun Transect
THAILAND
MALAYSIA
CHANGWAT SATUN
AMPHOE MUEANG SATUN
AMPHOE SADAO
PERLIS
KEDAH
Ban Khuan Pho
Ban Khok Pradu
Ban Wang Prachan
Ban Ton Ping
Ban Sanam Bin
Ban Ko Nok
Ban Tam Malang
Ban Pu-Yu
Kaki Bukit
Padang Besar
Ban Talat Thai
Ban Rok
Ban Khua Ko
Ban Khian Lak
Ban Dan Nok
Ban Thai-Changlon
Ban Kua Khuan
Kg. Bukit Keteri
Kayu Hitam
Bukit Batu Puteh
Pauh
Arau
Changlun

Malaysia-Thailand border stratigraphic correlation (before the study)

	Period		Malaysian side				Thai side	
			Langkawi Islands		Western Perlis	Kedah/Northern Perak	Southern Thailand (W)	Southern Thailand (E)
206 Ma	Upper	Triassic	Chuping Formation		Chuping Formation: Limestone member	Semanggol Formation	Lampang Group	
	Midle							
248	Lower							
	Upper	Permian	Singa Formation	Selang member	Chuping Formation: Clastic member	Gerik Formation	Khaeng Krachan Group	
290	Lower				Lubok Sireh Formation			
	Upper	Carboniferous		Ular Member	Kubang Pasu Formation	Kubang Pasu Formation	Khuan Klang Formation	Yaha Formation
				Kentut member				
354	Lower			Rebak member				
	Upper	Devonian	Langgun Redbeds		Jentik Formation	Kroh Formation	Pa Samed Formation	
	Middle							
	Lower		Upper Detrital Member					
417								

INTRODUCTION

- Malaysian Working Group reviewed the Carboniferous rocks along the Malaysia-Thailand border
- Target: The rock sequence in Langkawi-Perlis that exhibits similar lithological and palaeontological characteristics with the Khuan Klang Formation of Thailand

INTRODUCTION

- Joint study commenced in 2010
- Completed in 2012
- Several joint field checks carried out by both Working Groups
- On the Malaysian side: Langkawi Islands and western Perlis
- On the Thai side: in Satun Province

Singa Formation

Divisible into:

- Selang member
- Ular member
- Kentut member

} Permian – Middle Carboniferous

- Rebak member – base of the Singa Formation : Lower Carboniferous

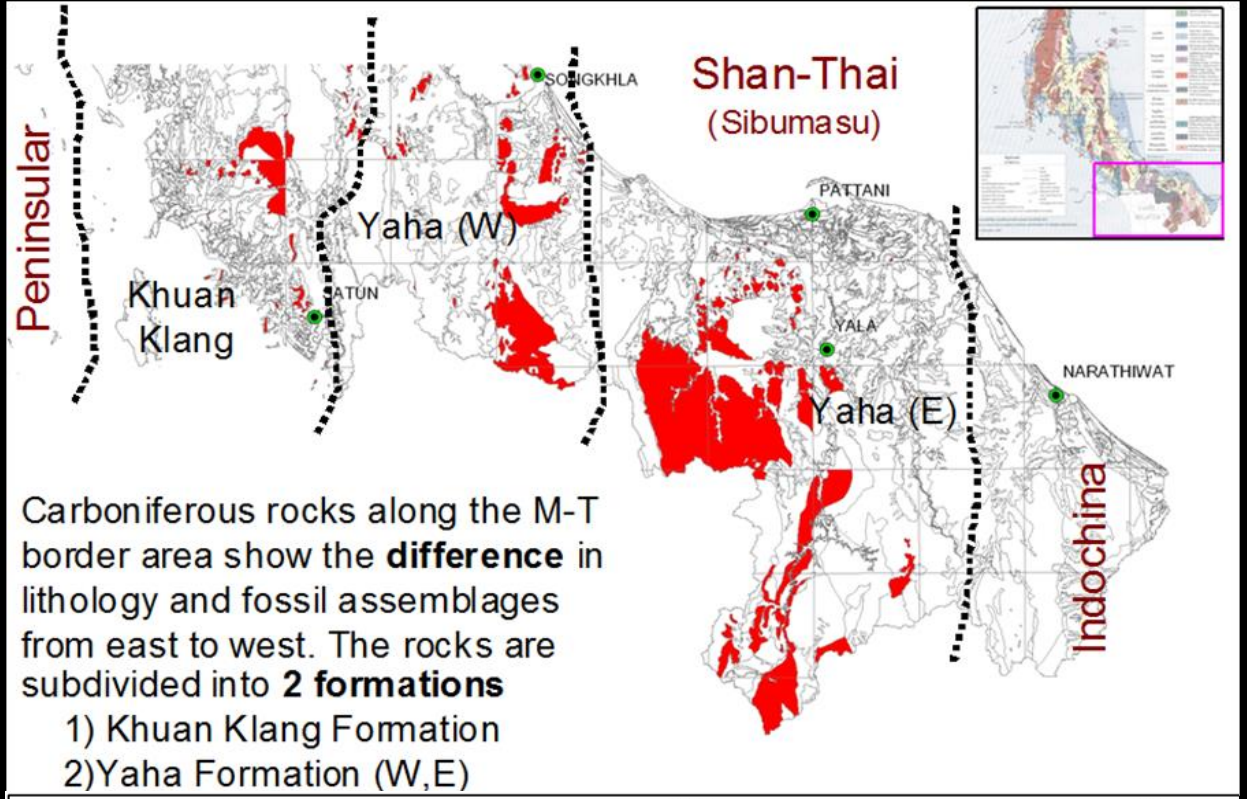
Rebak member

- Named after Rebak Island, SW Langkawi Islands
- Red and grey mudstone, siltstone and minor sandstone
- Base of the Singa Formation
- Fossils: Brachiopod *Worthenia* aff *orientalis* Roemer, bivalve *Posidonia* aff *siamensis* (Reed), *Posidonia* sp., trilobite *Cyrtosymbole (Waribole) perlisense* (Kobayashi & Hamada), crinoids and ostracods
- Age: Late Devonian up to Carboniferous

Khuan Klang Formation

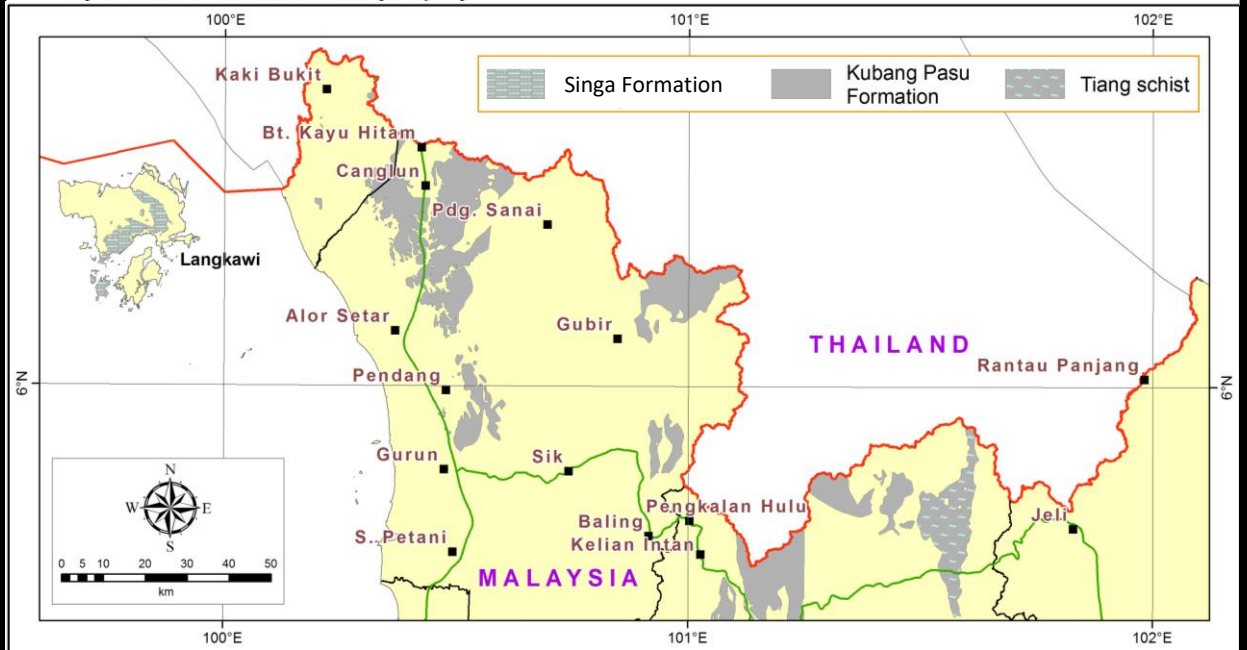
- Named after Khuan Klang hill (or so-call Khuan Sung) - 4 km west of the Satun city
- Sequence mudstone, shale and sandstone
- Fossils: *Posidonomya* sp. and pygidiums of trilobites, bivalves *Edmondia* sp., ammonite and crinoid stems, *Edmondia* sp., *Pterinopecten* sp., *Aviculopecten* sp., and *Allorisma* sp., Trilobites *Langgonbole vulgaris* and *Dalmanites* sp.?, brachiopods *Chonetes* sp. and *Echinoconchus* sp., ammonites *Agathiceras* sp. and *Euomphalus* sp., gastropod *Pronorite* sp.?, ostracods and crinoids
- Age: Late Devonian to Early Carboniferous

DISTRIBUTION



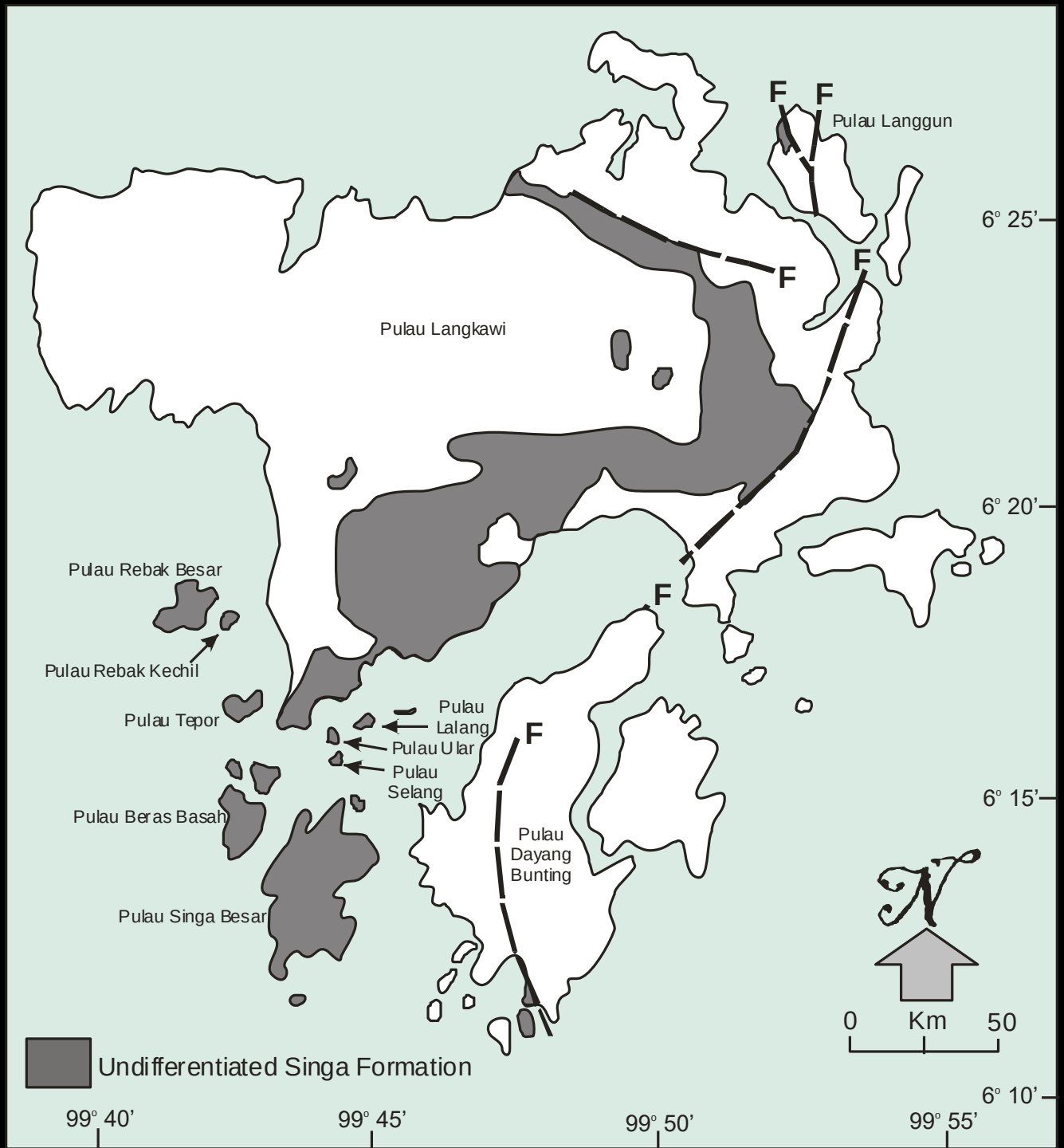
Distribution of Carboniferous rocks

Thai side

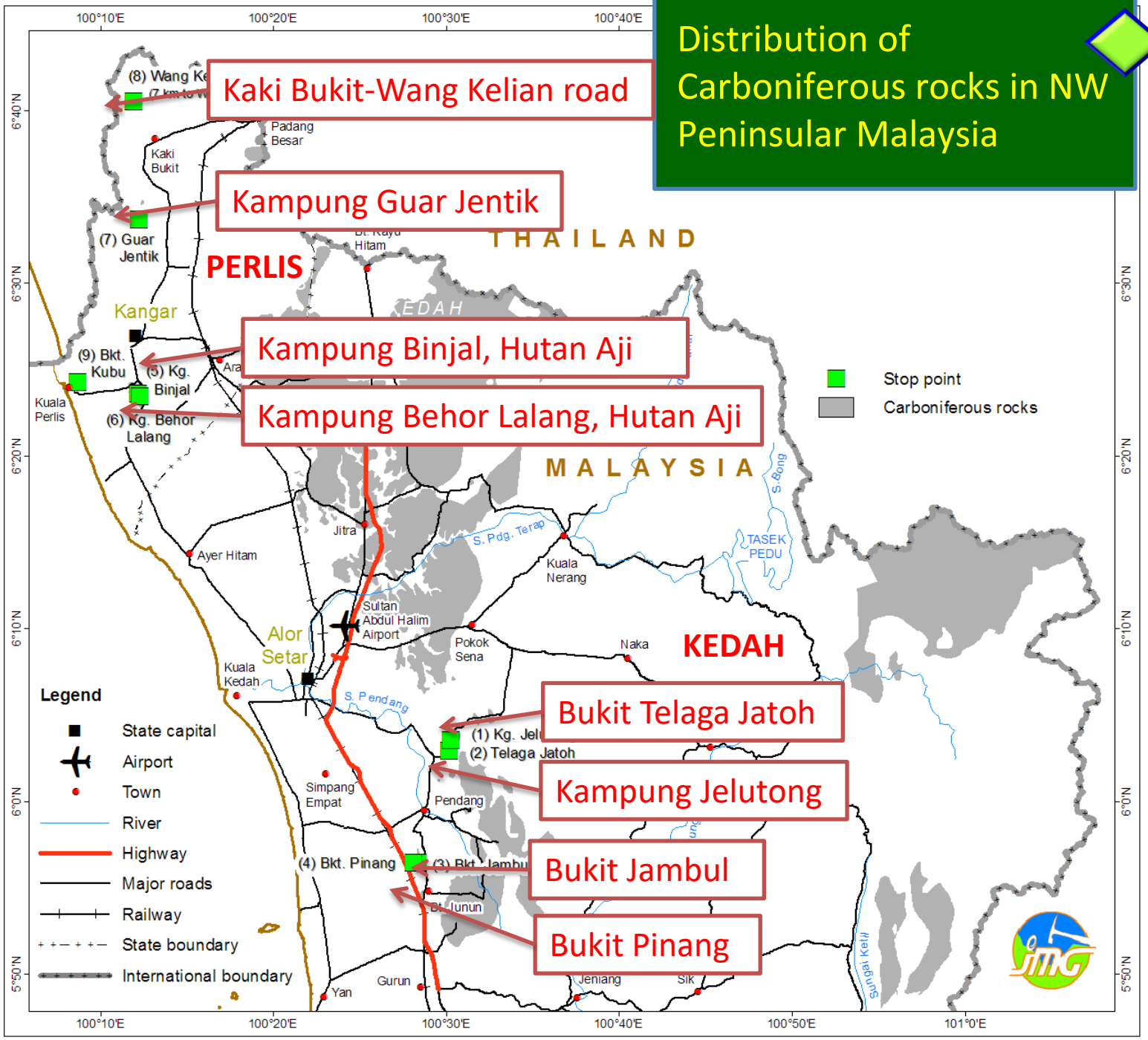


Malaysian side

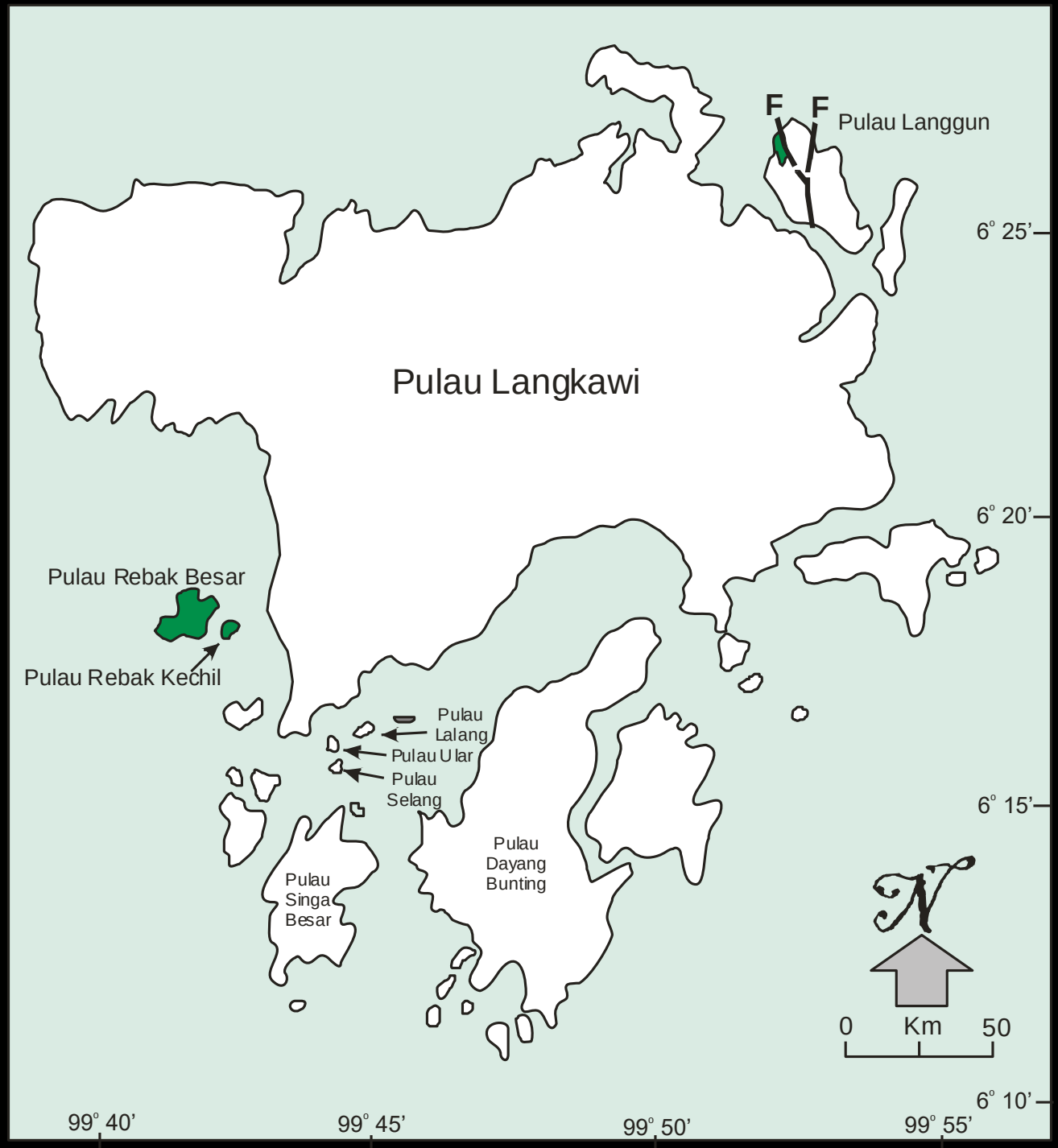
Distribution of the Singa Formation in Langkawi Islands (Late Devonian-Permian)



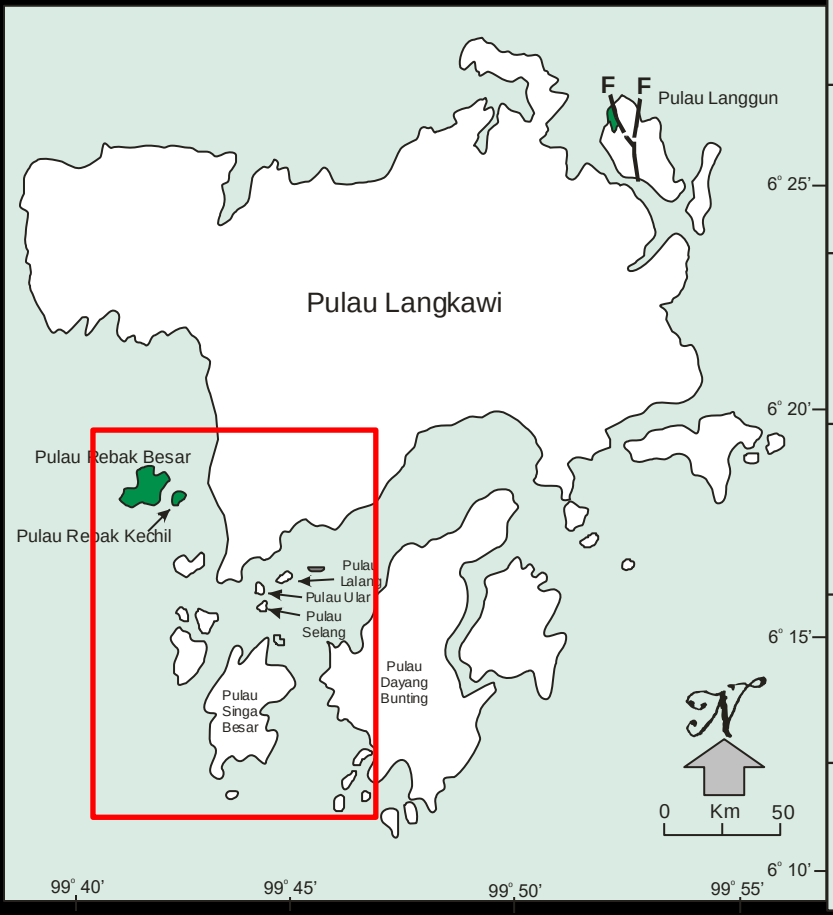
ON THE MALAYSIAN SIDE

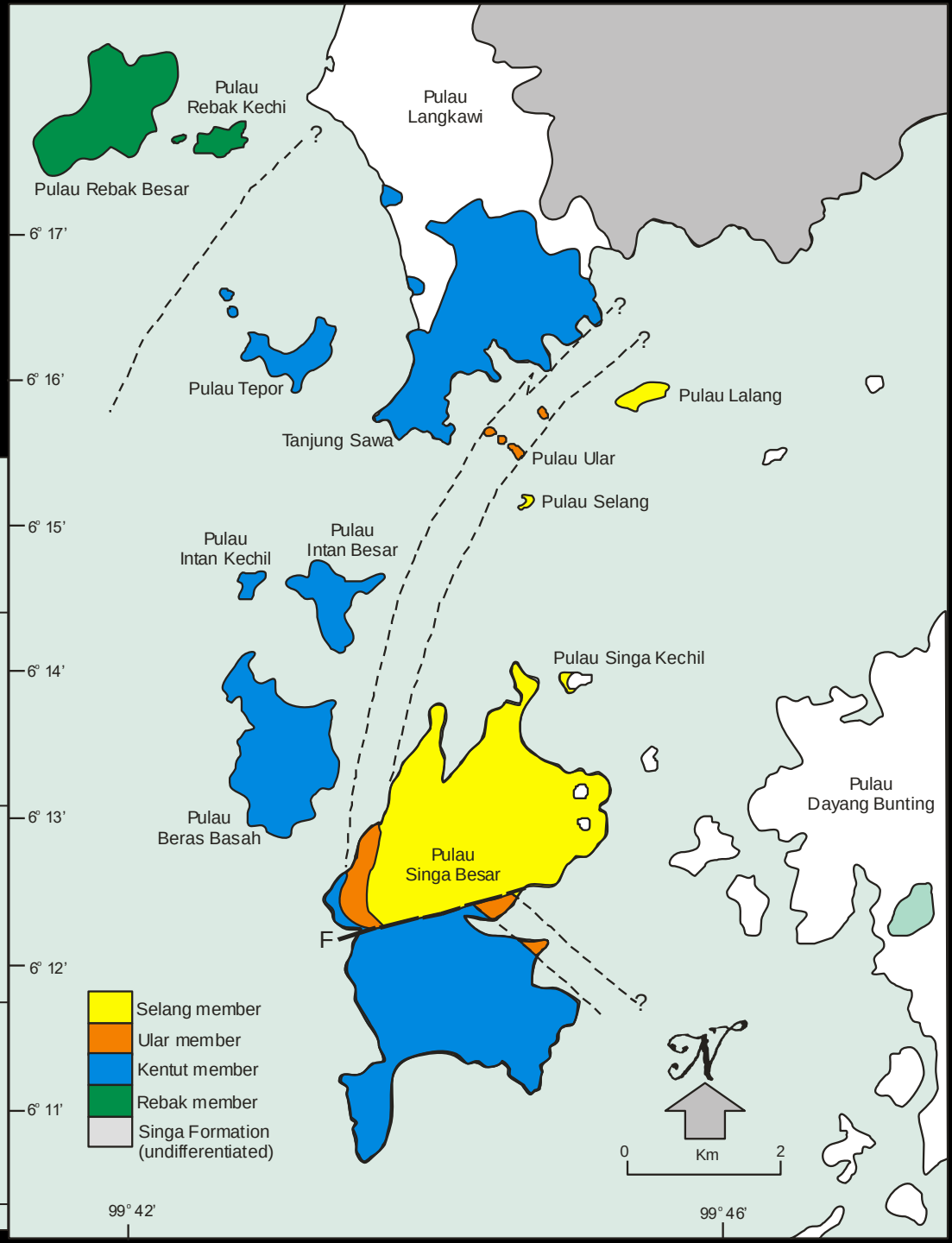


Distribution of Rebak member of the Singa Formation in Langkawi Islands

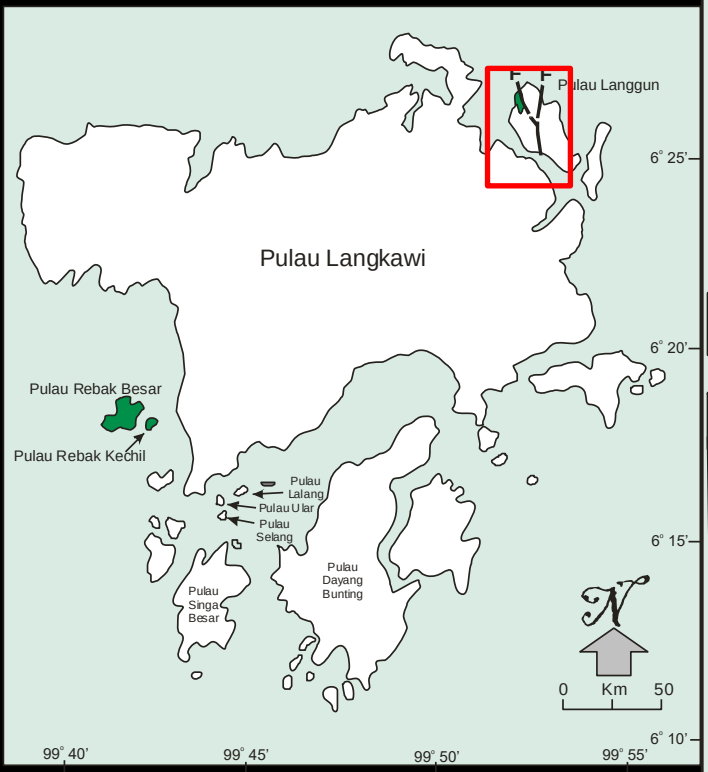


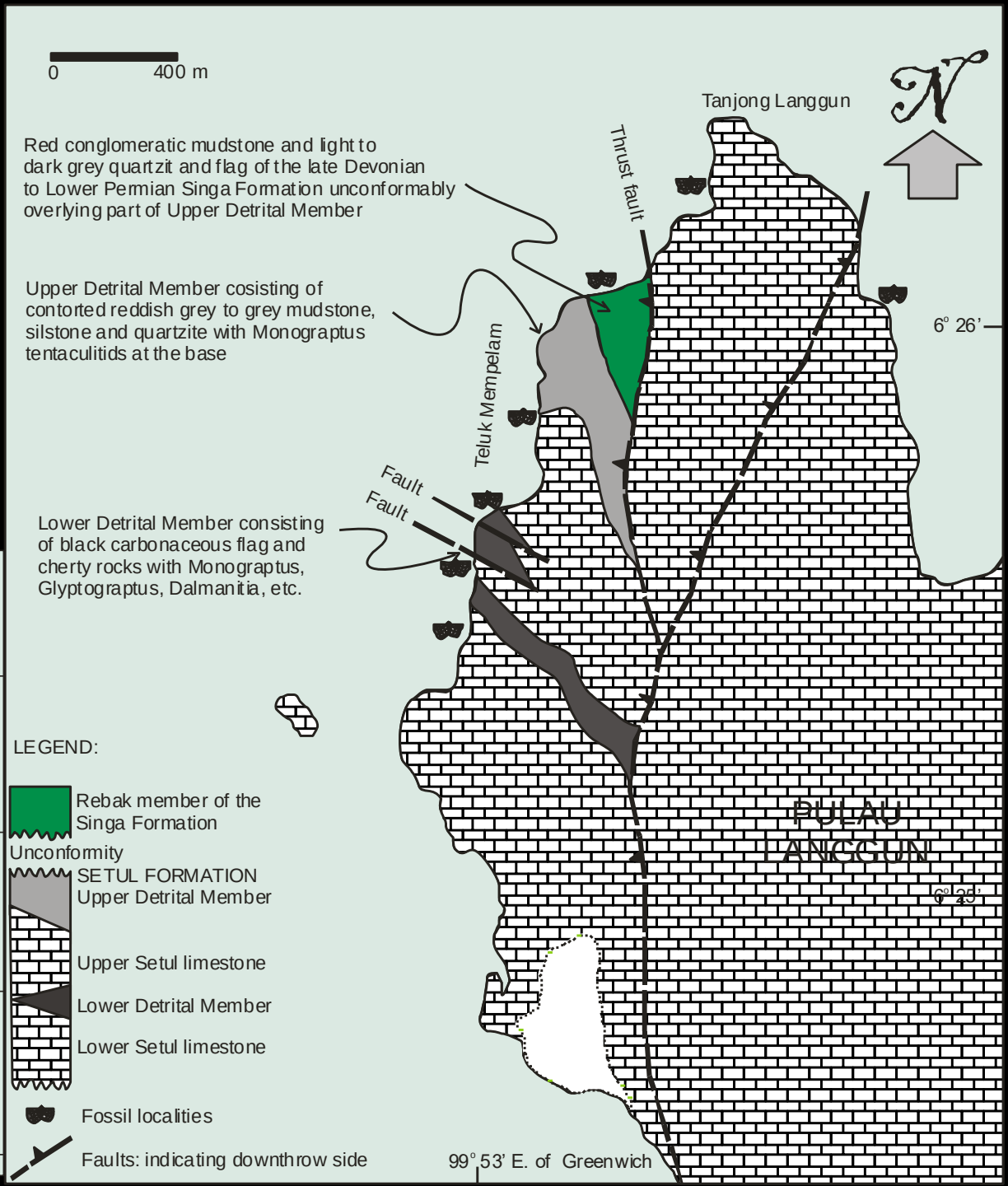
Distribution of members of the Singa Formation in SW Langkawi Islands



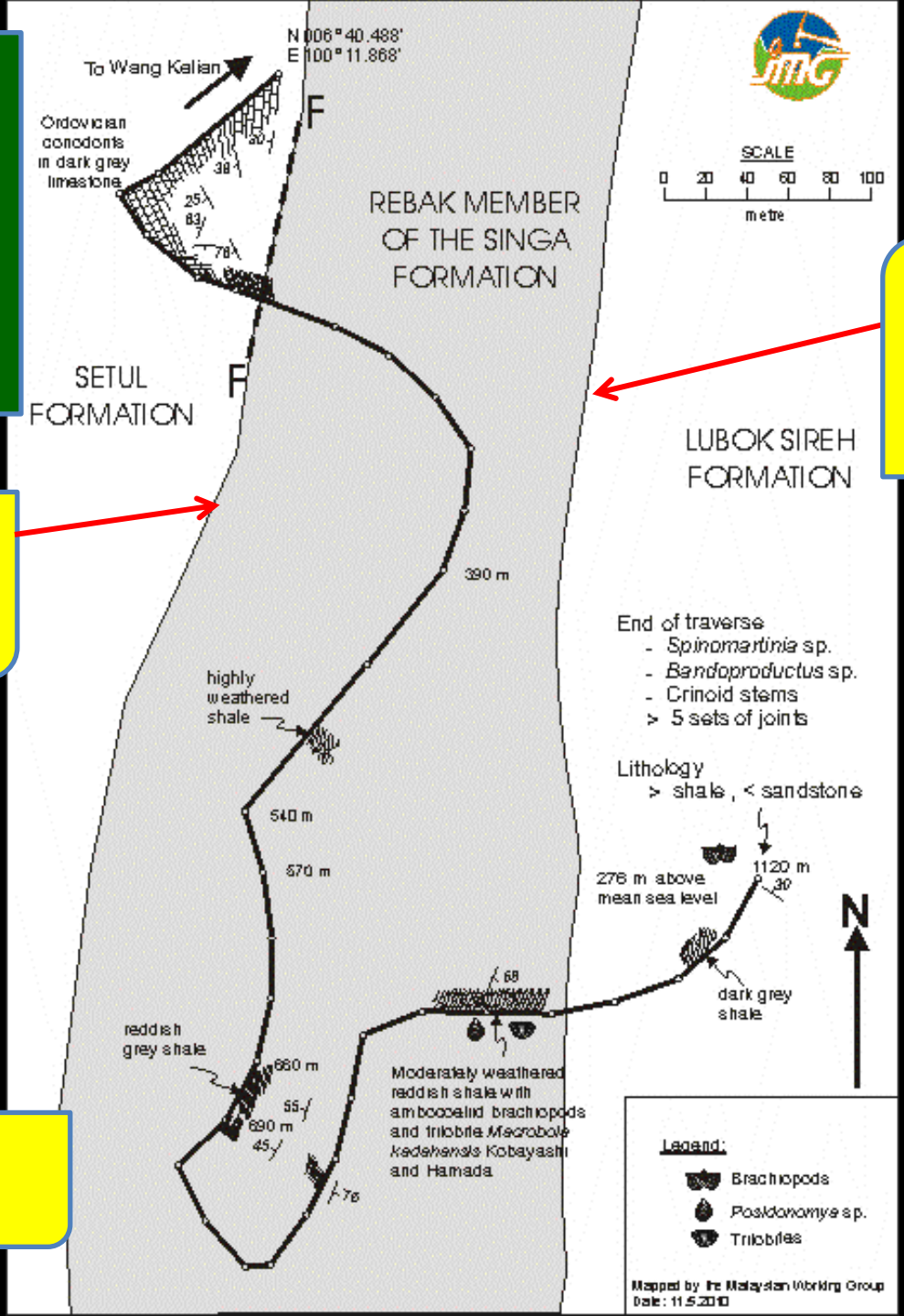


Distribution of Rebak member in Langgun Island





Rebak member of the Singa Formation at Kaki Bukit-Wang Kelian road

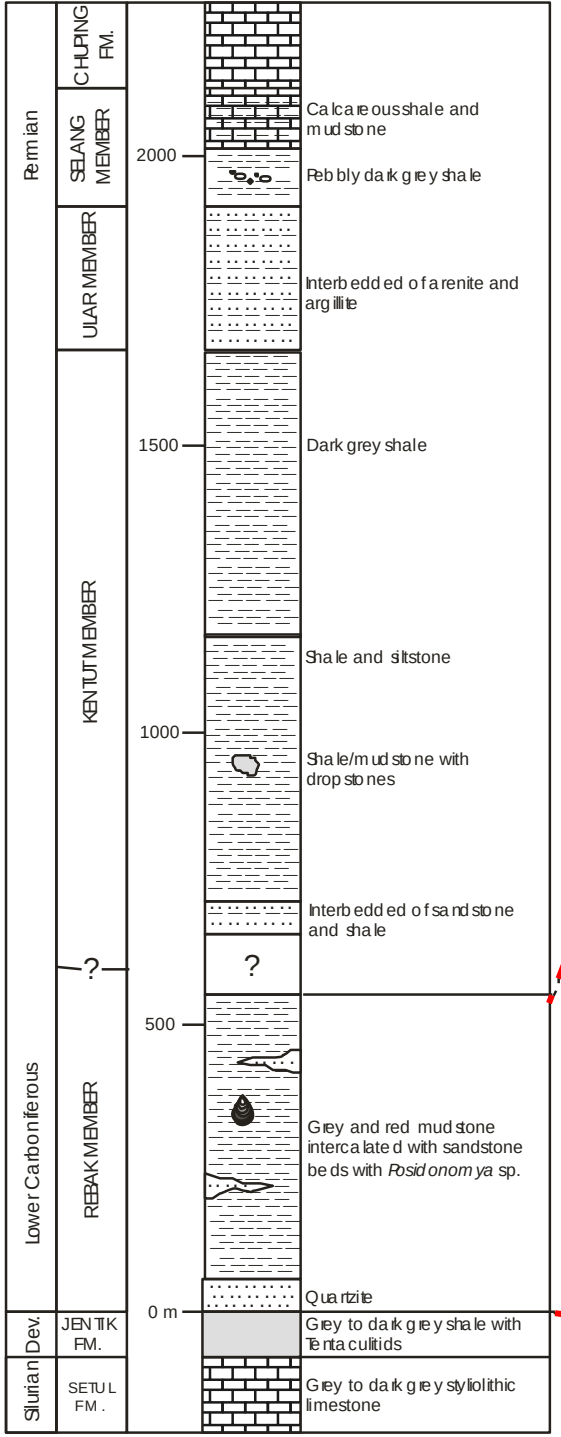


Upper boundary of the Rebak member

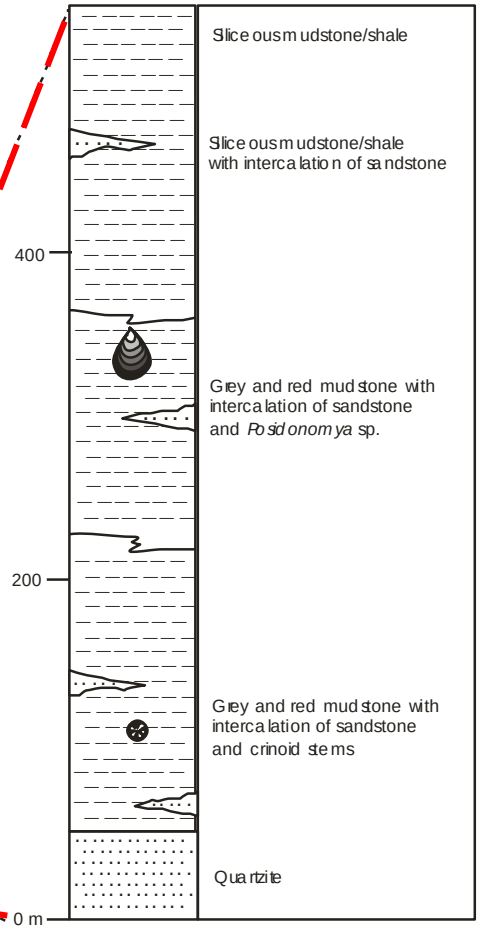
Lower boundary of the Rebak member

1.12 km stretch mapped

Composite stratigraphic column of the Singa Formation

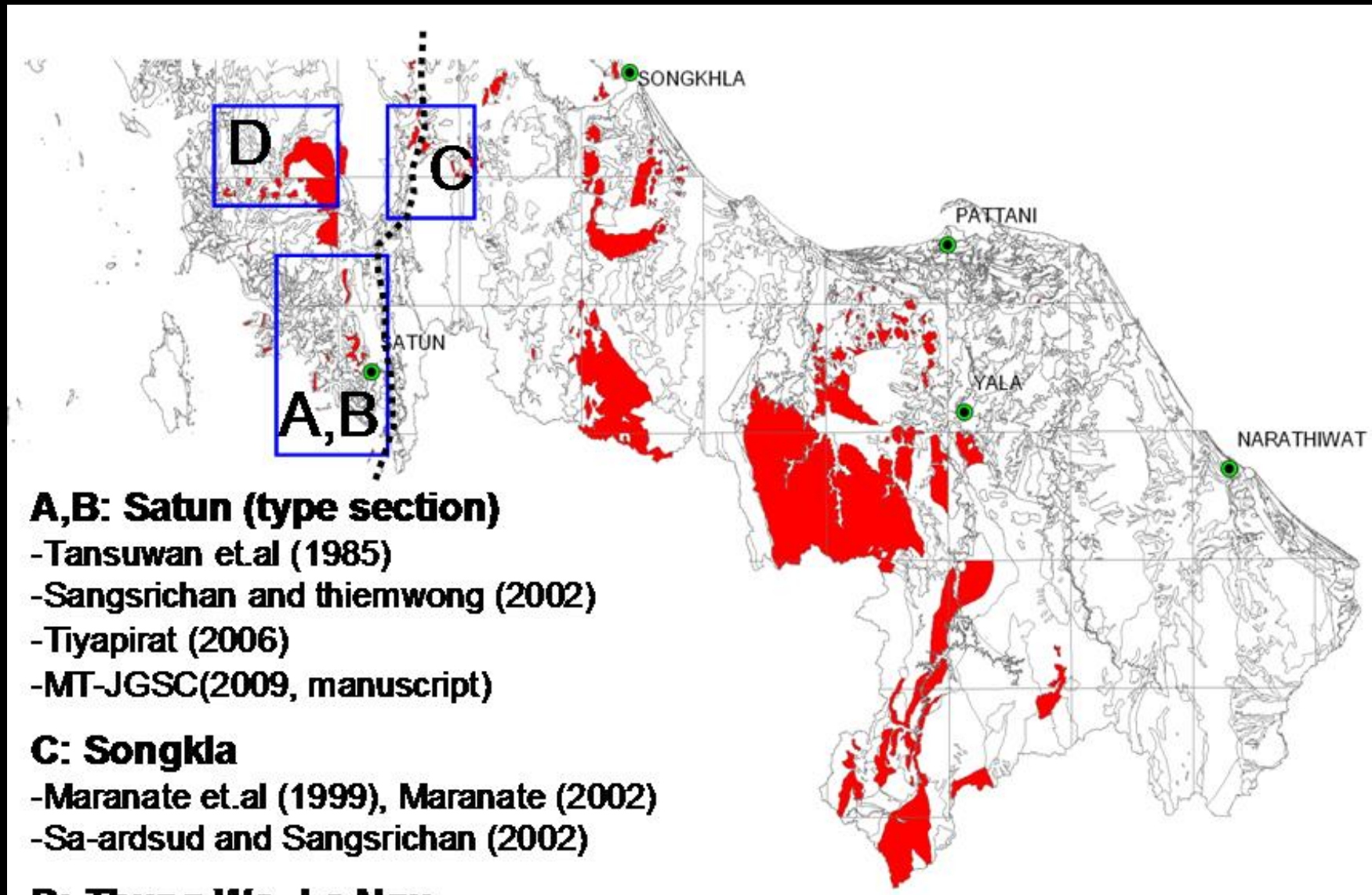


Composite stratigraphic column of the Rebak member



(modified from Shabri Lebai Din, 1982)

Khuan Klang Formation



A,B: Satun (type section)

-Tansuwan et.al (1985)
-Sangsrichan and thiemwong (2002)
-Tiyapirat (2006)
-MT-JGSC(2009, manuscript)

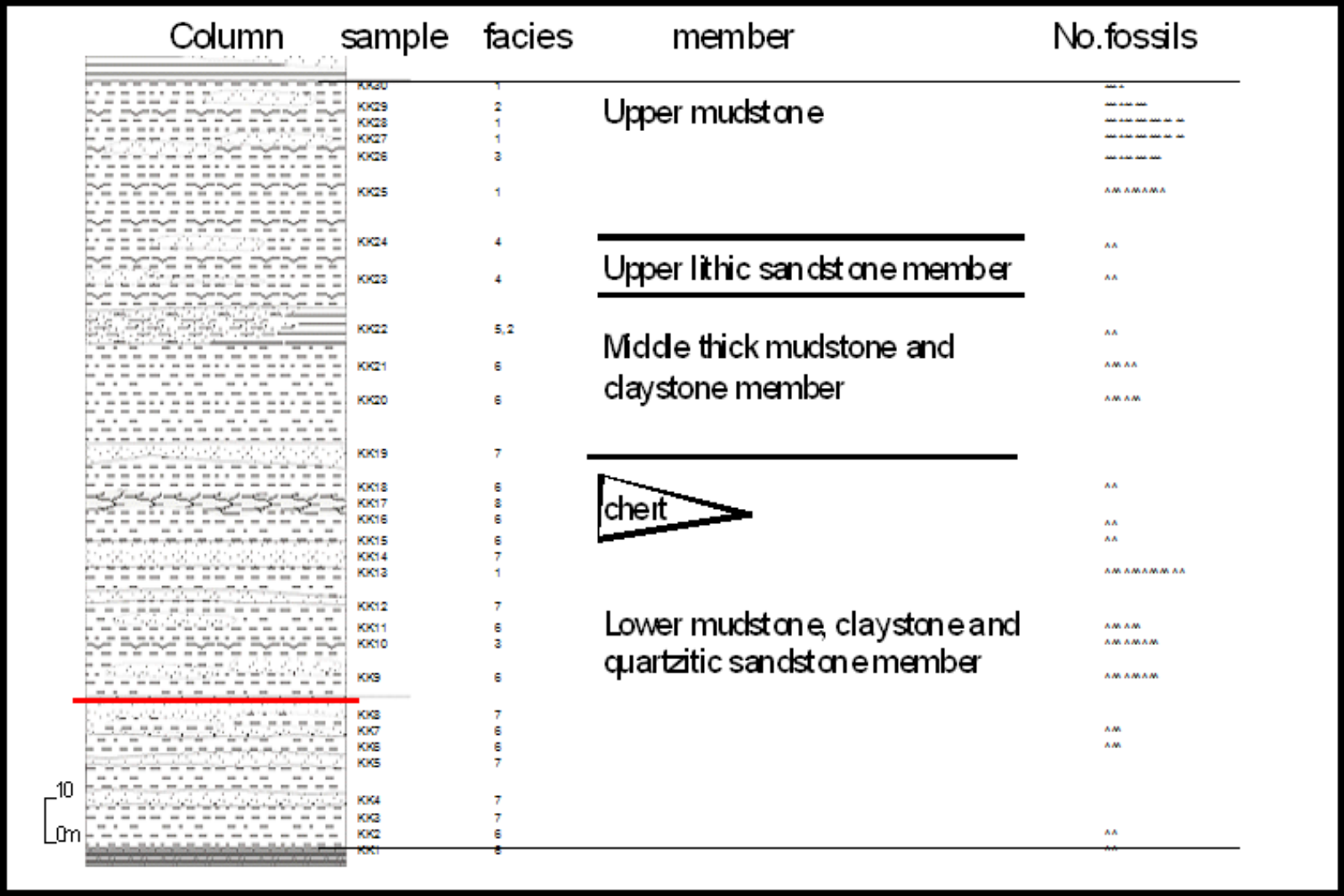
C: Songkla

-Maranate et.al (1999), Maranate (2002)
-Sa-ardsud and Sangsrichan (2002)

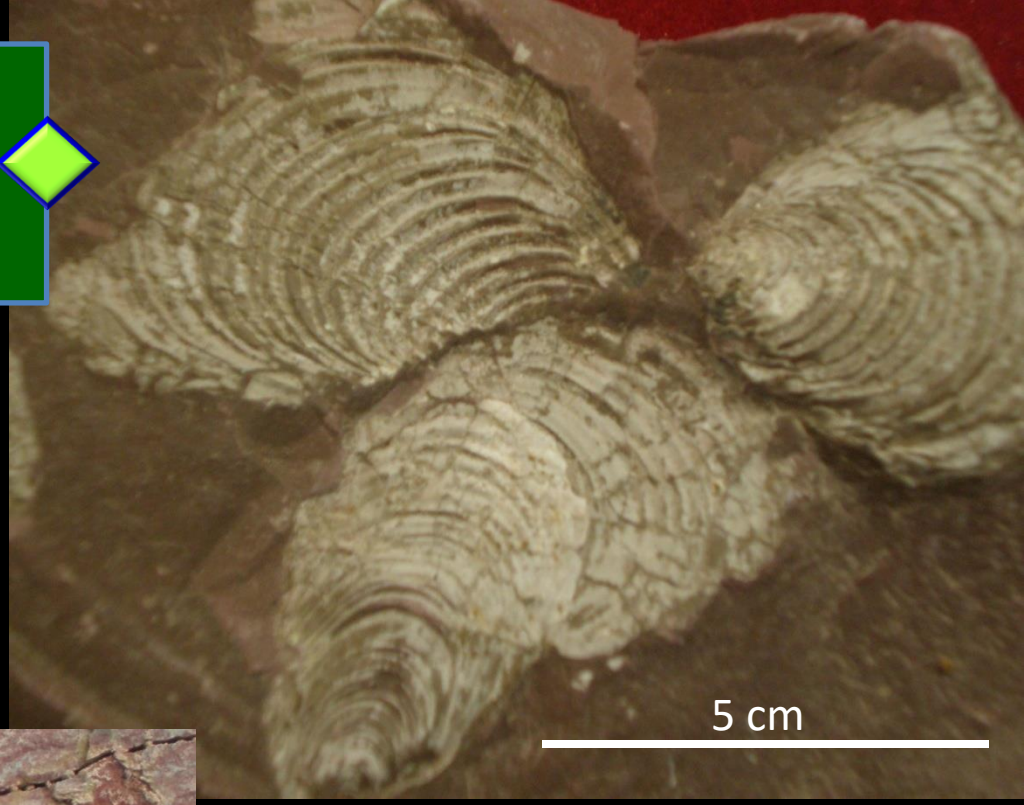
D: Thung Wa- La Ngu

-Sangsrichan (2006)

Composite stratigraphic column of the Khuan Klang Formation in Thailand



Posidonomya sp. at Wang Kelian road cut, Malaysia



Posidonomya sp. at an earth quarry in Khlong Kut, Thailand

TYPE SECTION

- MALAYSIAN SIDE: northwest coast of Langgun Island – overlying conformably the Devonian Jentik Formation. The exposure at the type section extends about 200 m along the beach in the NE-SW direction.
- THAI SIDE: a large quarry currently mined at Khuan Sung, Si-ngam village, Khuan Kat Urban, Muang District, Satun Province. The type section can be accessed by road no 4051 (Muang-Ban Khuan Mai). Grid reference of the section is 615552E 0731806N in Changwat Satun (5022 III) sheet at scale1:50,000.

MALAYSIAN SIDE

Type section of the Rebak member of the Singa Formation at NW coast of Langgun Island

Red mudstone of the Rebak member with trilobite and brachiopods at Langgun Island

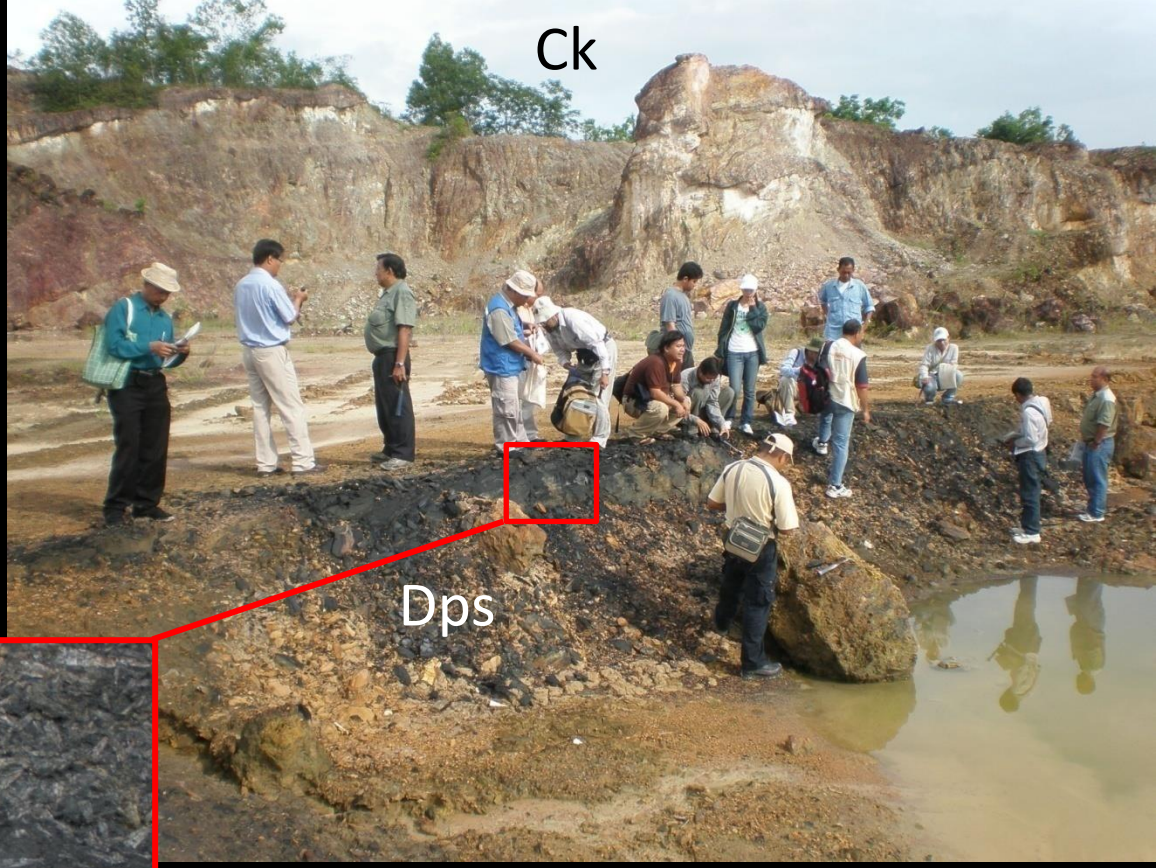
Black shale with tentaculitids underlying the Rebak member

THAI SIDE

Type section of the Khuan Klang Formation at Khuan Sung, Si-ngam village, Khuan Kat Urban, Muang District, Satun Province

Continuous sequence from Devonian-Carboniferous-Permian

Lower contact of the Khuan Klang Formation in Khuan Sung



Ck – Carboniferous Khuan Klang Fm.
Dps – Devonian Pa Samed Fm.

Upper contact of the Khuan Klang Formation in Khuan Sung

Pkk – Permian Khaen Krachan Group
Ck – Carboniferous Khuan Klang Fm.

REFERENCE SECTIONS

- MALAYSIAN SIDE:
  - ❑ Rebak Besar Island, Langkawi
  - ❑ Hutan Aji, Perlis
  - ❑ Kampung Guar Jentik, Perlis
  - ❑ Kaki Bukit-Wang Kelian Road, Perlis

REFERENCE SECTIONS

- THAI SIDE:
  - Klong Khut area, Klong Khut Urban, Muang District, Satun Province
  - Khuan Din Daeng, Muang District, Satun Province
  - Ban Thung Wiman-Ban Kalan Yi Tan, Muang District, Satun Province
  - road from Manang District – Phu Pha Phet cave (3014), Manang District, Satun Province
  - short cut road from Manang to Phu Pha Phet cave, Manang District, Satun Province.
  - Ban Kuha, Rattaphum District, Songkhla Province


Transitional sequence from Devonian Jentik Formation to Lower Carboniferous Rebak member of the Singa Formation at Kampung Guar Jentik
Rebak member of the Singa Formation
Jentik Formation

Thick-bedded pinkish white mudstone with *Posidonomya* sp. on the Thai side

Quartzitc sandstone interbedded mudstone-claystone on the Thai side

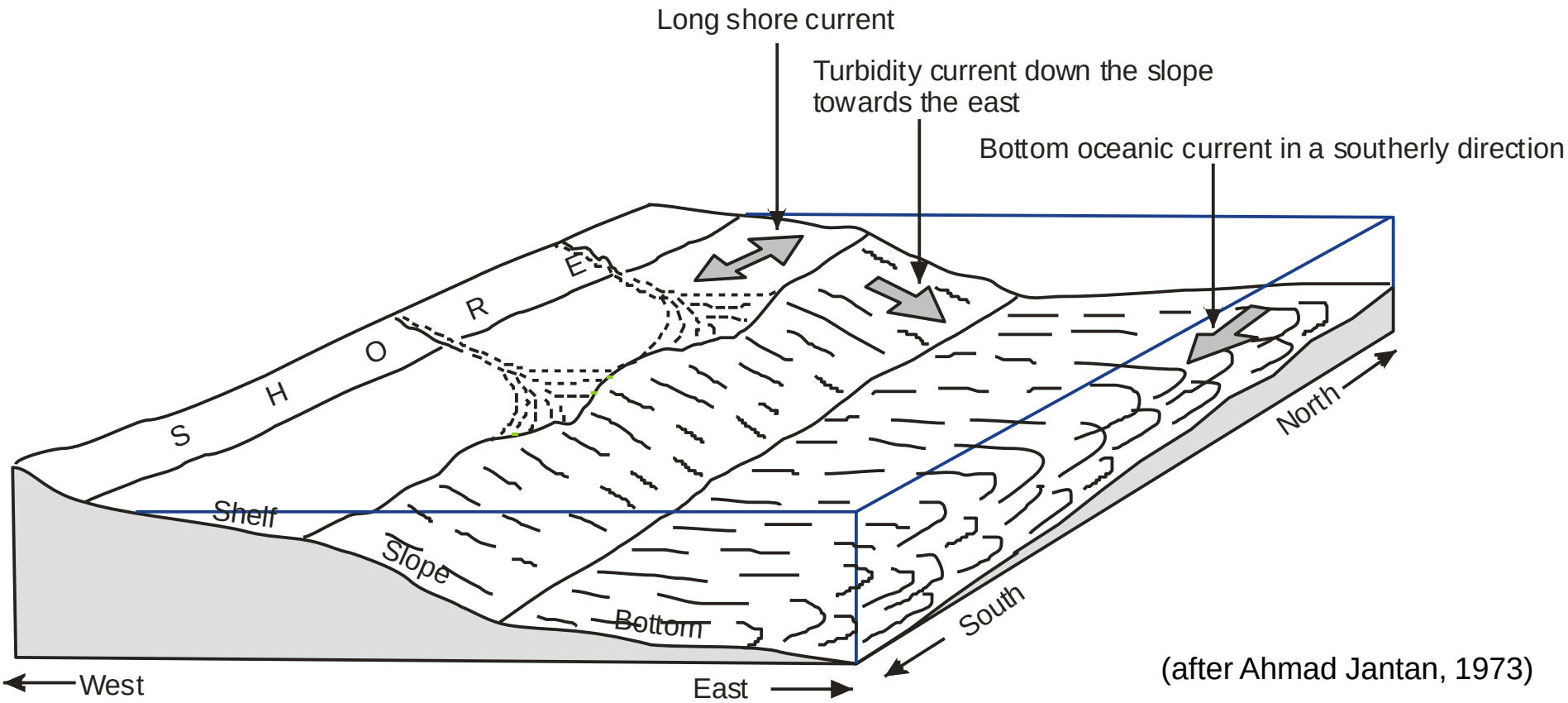
AGE

- Late Devonian-Early Carboniferous
- based on fossils
- MALAYSIAN SIDE:
  - brachiopod *Worthenia* aff *orientalis* Roemer, bivalve *Posidonia* aff *siamensis* (Reed), *Posidonia* sp., trilobite *Cyrtosymbole (Waribole) perlisense* Kobayashi and Hamada, crinoids and ostracods
- THAI SIDE:
  - *Agathiceras* sp., *Cypricardella* sp.?, *Rugosochonetes* sp., *Langgonbole vulgaris, Macrobole* sp., *Chonetes* sp. *Posidonomya* sp., *Aviculopecten* sp., *Pericydus* sp.

DEPOSITIONAL ENVIRONMENT

- deposited in the upper subtidal environment to continental slope of the marine environments
- lamination indicates that the sequence had been deposited intermittently, rapidly from sediments in suspension that was transported by local turbidity currents
- commonly rich in ferric iron oxide (hematite) that present as cementing materials. This indicates that it was deposited in oxidizing condition - occurs in the open basin of moderate depth in the open sea with free circulated water
- Slump structures that commonly occurs might have been initiated by the sediment's own weight or by tectonic shocks, earth tremors and earthquakes, or by both

Depositional environment of the Rebak member/Khuan Klang Formation



(after Ahmad Jantan, 1973)

CONCLUSION

- Lithologically, stratigraphically and palaeontologically – Rebak Member of the Singa Formation Formation is correlatable with the Khuan Klang Formation
- argillaceous dominant
- latest Devonian to early Carboniferous faunas
- deposited in tidal flat to upper subtidal environment to a continental slope environment

CONCLUSION

- The Working Group would like to propose the proper Singa Formation is composed of Kentut, Ular and Selang members which are correlatable with the Kaeng Krachan Group of Thailand
- The Rebak member will stand by itself – subject to further detailed study

Correlation of Carboniferous rock units along the Malaysia-Thailand border area (after the study)

ERA	MALAYSIA		THAILAND	
Carboniferous	Perlis/ Langkawi	Kedah	East	West
	Rebak member of the Singa Formation	Kubang Pasu Formation	Khuan Klang Formation	Yaha Formation


Terima kasih…
คบ-กัน-ครับ.
Thank you
for your attention