CHAPTER 4

PALEONTOLOGY

4.1 Introduction

The carbonate rocks in the Chiang Dao area have a great diversity of bioclasts. These bioclasts include foraminifera, ostracods, small gastropods, brachiopods, bryozoa, echinoderms, and calcareous algae. In this study, only the foraminifera were studied because they are abundant, especially the foraminifera from the Late Paleozoic onward. These foraminifera are important for dating rocks and for paleo-environmental determination.

Twenty taxas of foraminifera fauna (Table 4.1) from the carbonate samples were collected. Four of these are important index foraminifera species. These four are *Fusulinella pseudobocki* and *Beedeina elegans*, which indicate the Middle Carboniferous Moscovian, and *Pseudoschwagerina* sp. and *Triticites* sp., which indicate the Early Permian Asselian. The occurrence of these four foraminifers species indicates that the boundary between the Carboniferous and the Permian Periods should be within the study area.

Table 4.1 Fusulinids and other foraminifera from the study area.

Fauna	Outcrop section							
Fusulinids	**KTP**	**CD 92**	**CD 4**	**CD 93**	**CD 93.1**	**CD 1**	**CD 2**	**CD 3**
1) *Eostaffella* sp.	✓							
2) *Ozawainella* sp.	✓							
3) *Neostaffella* sp.	✓							
4) *Profusulinella* sp.	✓							
5) *Fusulinella pseudobocki*	✓							
6) *Beedeina elegans*	✓							
7) *Staffella* sp.	✓							
8) *Pseudoendothyra* sp.	✓							
9) *Pseudoschwagerina* sp.								✓
10) *Triticites* sp.								✓
Small foraminifera								
1) *Biseriella parva*	✓			✓		✓		
2) *Globivalvulina* sp.	✓		✓	✓	✓			✓
3) *Spiroplectammina* sp.	✓							
4) *Climacammina* sp.	✓	✓					✓	✓
5) *Endothyranopsis* sp.	✓			✓				
6) *Bradyina* sp.	✓	✓						
7) *Endothyra* sp.	✓							
8) *Tetrataxis* sp.	✓	✓						✓
9) *Eolasiodiscus* sp.	✓	✓		✓				
10) *Eoschubertella* sp.				✓		✓		

4.2 Previous work

Ueno and Igo (1997) studied the limestone in the Chiang Dao area along highway 107 between kilometers 91.5 and 99.5. Their faunal findings are as follows:

4.2.1 The Khao Tham Pong quarry

Seventy-six foraminifera taxa were found in samples collected at the Khao Tham Pong quarry. The oldest of these foraminifera is *Biseriella parva*, which indicates a late Visean to early Serpukhovian age. The next younger foraminifera is *Profusulinella prisca timanica,* which is Moscovian in age. Another Moscovian age foraminifera found is *Beedeina elegans,* which is referable to the Moscovian Podolsky Horizon. The youngest foraminifera found in the Khao Tham Pong quarry is *Fusulinella pseudobocki*, which is a diagnostic Latest Moscovian foraminifera.

4.2.2 The kilometer 93.1 outcrop

The Late Yakhtashian foraminifera *Pamirina (P.) darvasica* was found at this location.

4.2.3 The kilometer 99.5 outcrop

A limestone sample near the entrance to a small cave contained both *Verbeekina verbeeki* and *Neoschwagerina margaritae*. These foraminifera are index species of the Late Murghabian to Midian of the Middle Permian.

4.3 Recent study

The following descriptions of faunas from the eight outcrop sections are from the oldest, Khao Tham Pong quarry, to the youngest, outcrop CD 3.

4.3.1 The Khao Tham Pong quarry section

The rock samples in the quarry are oosparite, pelsparite, intrasparite, and cortoidsparite microfacies. Seventeen foraminifera were identified from 100 thin sections. Eight of these are fusulinids: *Eostaffella* sp., *Ozawainella* sp., *Neostaffella* sp., *Profusulinella* sp., *Fusulinella pseudobocki*, *Beedeina elegans*, *Staffella* sp., and *Pseudoendothyra* sp.. The other nine are small foraminifera: *Biseriella parva*, *Globivalvulina* sp., *Spiroplectammina* sp., *Climacammina* sp., *Endothyranopsis* sp., *Bradyina* sp., *Tetrataxis* sp., and *Eolasiodiscus* sp. Of these 17 foraminifera, the most important ones are *Fusulinella pseudobocki* and *Beedeina elegans*. These two foraminifera indicate the Moscovian of the Middle Carboniferous (Figure 4.1).

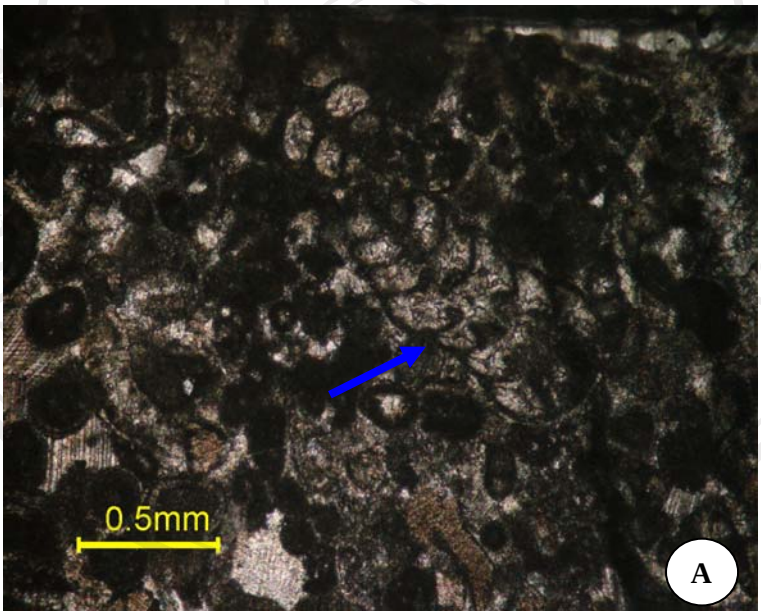


Figure 4.1 Khao Tham Pong quarry foraminifera.
A) *Climacammina* sp. (arrow)

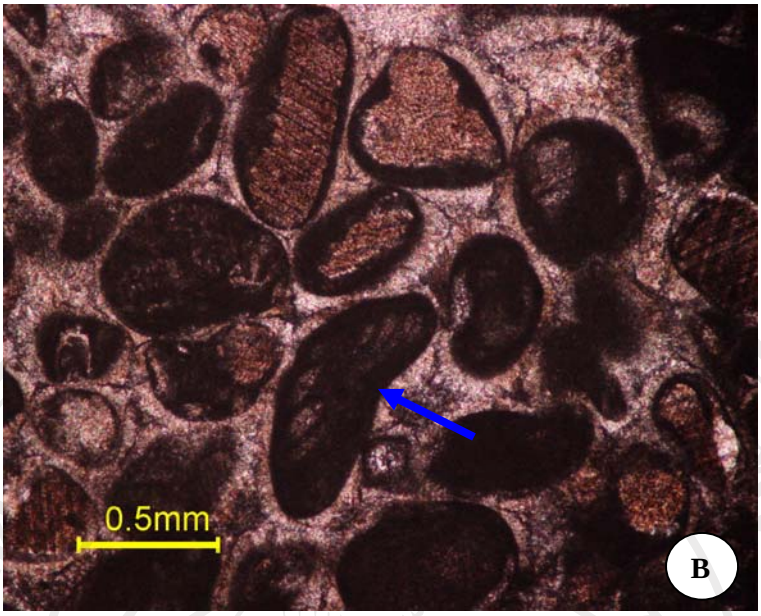


Figure 4.1 Khao Tham Pong quarry foraminifera.
B) *Tetrataxis* sp. (arrow)

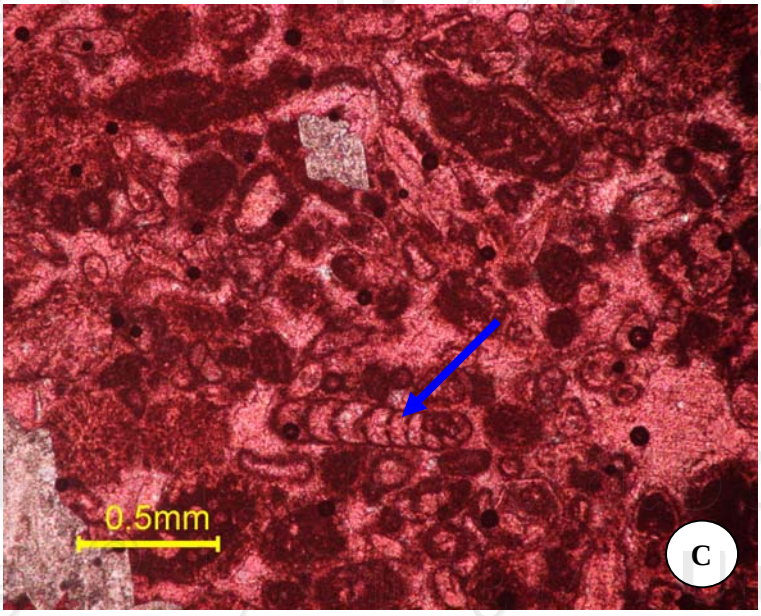


Figure 4.1 Khao Tham Pong quarry foraminifera.
C) *Spiroplectammina* sp. (arrow)

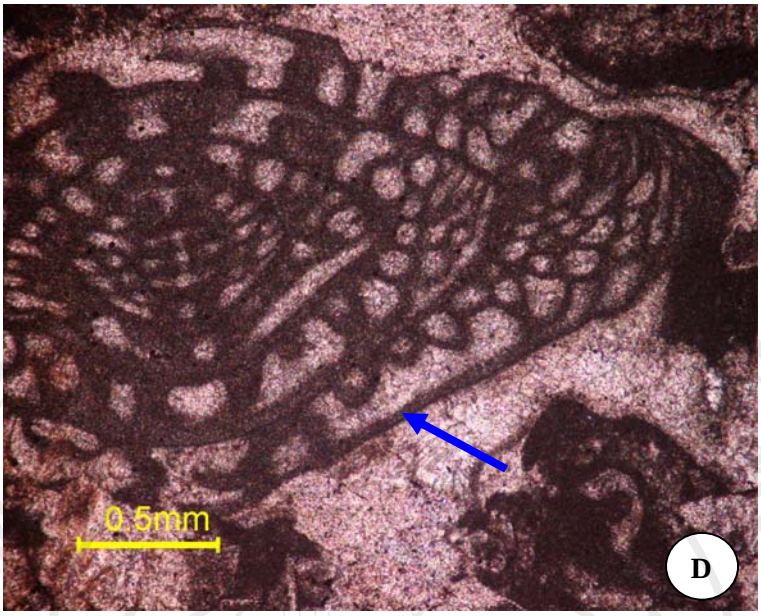


Figure 4.1 Khao Tham Pong quarry foraminifera.
D) *Beedeina elegans.* (arrow)

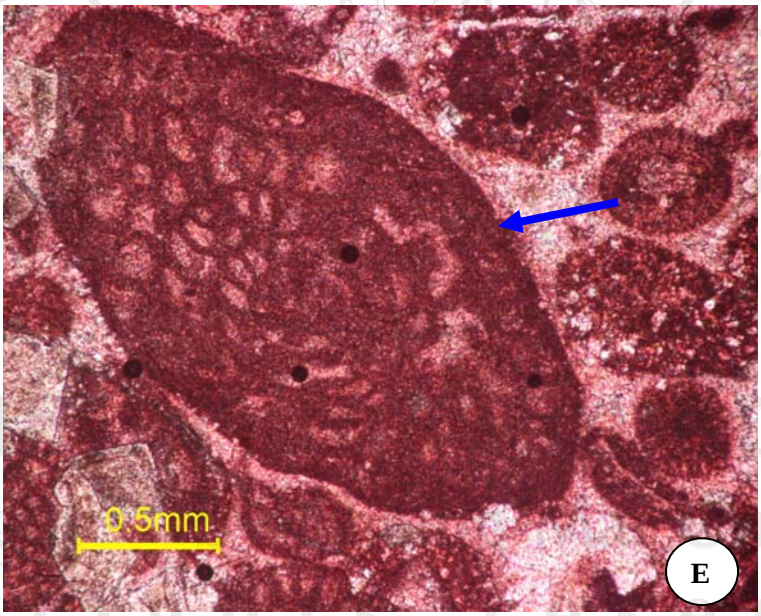


Figure 4.1 Khao Tham Pong quarry foraminifera.
E) *Fusulinella pseudobocki.* (arrow)

4.3.2 The CD 92 outcrop section

Rocks at the CD 92 section are biosparite and biomicrite microfacies. The bioclasts of these rocks are mainly dasycladaceans, though there are shell fragments, echinoderm plates, bryozoa, and ostracods. Though small foraminifera are rare, four of these are *Climacammina* sp., *Bradyina* sp., *Tetrataxis* sp., and *Eolasiodiscus* sp. These foraminifera indicate a Late Carboniferous age (Figure 4.2).

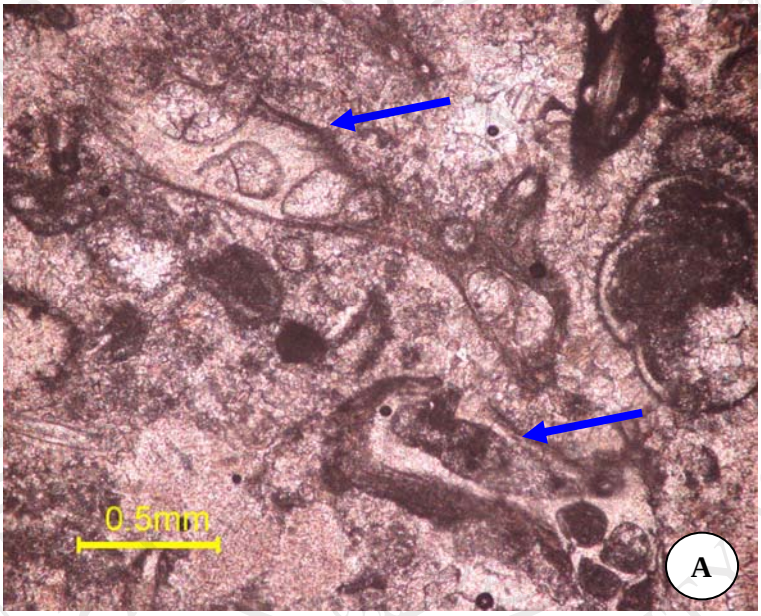


Figure 4.2 CD 92 outcrop section fauna.
A) Dasycladaceans (arrow)

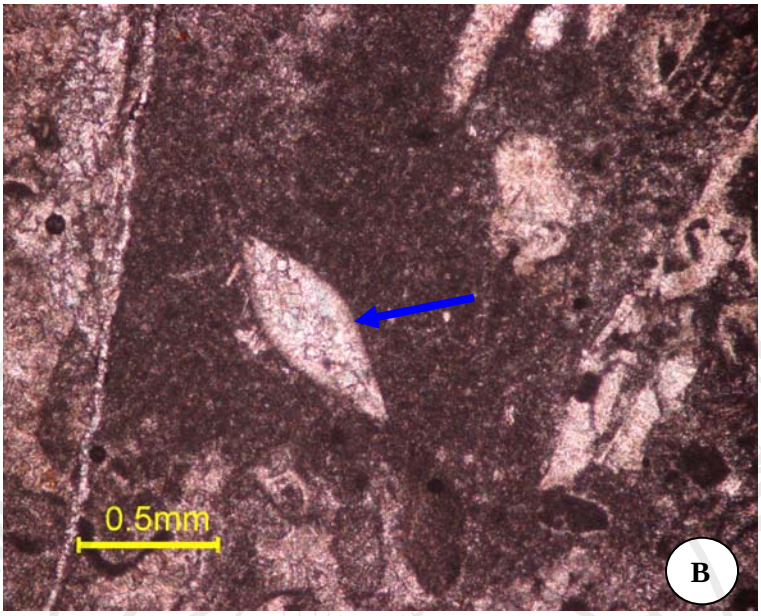


Figure 4.2 CD 92 outcrop section fauna.
B) Ostracod (arrow)

4.3.3 The CD 4 outcrop section

The CD 4 section rocks are biomicrite microfacies. However, most samples have been dolomitized, thus, identifiable fossils are rare. Furthermore, the depositional environment of this biomicrite microfacies is not suitable for the foraminifera and suggests that foraminifera should be very rare in this locality. The bioclasts are dominantly phylliod calcareous green algae. Other bioclasts are shell fragments, echinoderm plates, bryozoa, hexaphyllia coral, brachiopod spines, and ostracods. Being rare, the only small foraminifera identified is *Globivalvulina* sp. The foraminifera that occur suggest a Late Carboniferous to Permian age.

4.3.4 The CD 93 outcrop section.

The CD 93 limestone section are a biosparite microfacies. Although, small foraminifera are rare, four that have been identified are *Biseriella parva*, *Globivalvulina* sp., *Endothyranopsis* sp., and *Eolasiodiscus* sp. these foraminifera suggest a Late Carboniferous age (Figure 4.3).

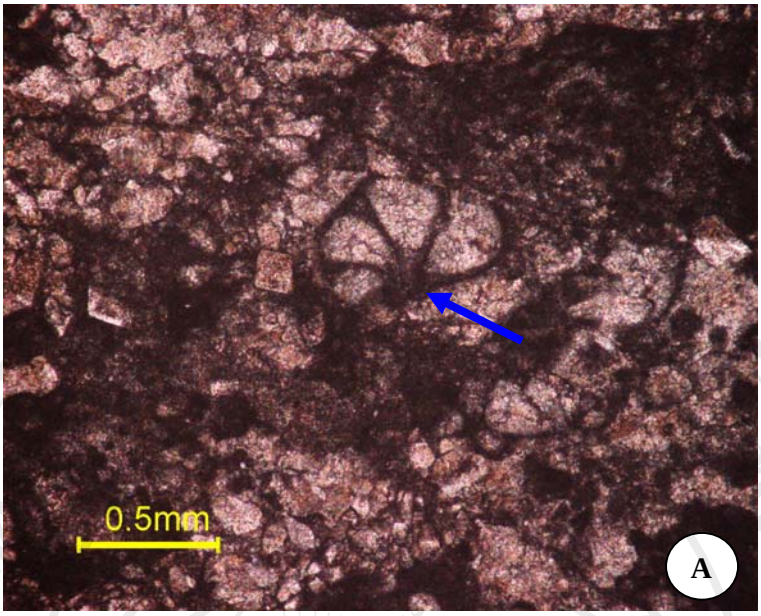


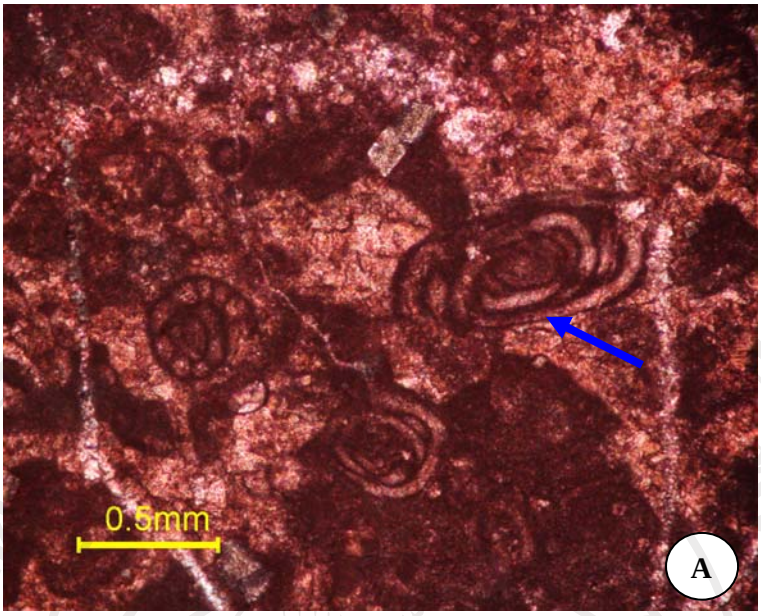
Figure 4.3 CD 93 outcrop section fauna.
A) *Biseriella parva* (arrow)

4.3.5 The CD 93.1 outcrop section

Ueno and Igo (1997) found an important foraminifera fauna, *Pamirina (P.) darvasica*, in this outcrop section. This foraminifera indicates the late Early Permian Late Yakhtashian. However, in this study only one foraminifera was found in this outcrop section, *Globivalvulina* sp., which indicates a Late Carboniferous to Permian age.

4.3.6 The CD 1 outcrop section

The limestone in the CD 1 outcrop section is biosparite microfacies. The bioclasts are small foraminifera and two of these are *Globivalvulina* sp., *and Eoschubertella* sp. (Figure 4.4). These foraminifera suggest a Late Carboniferous age.



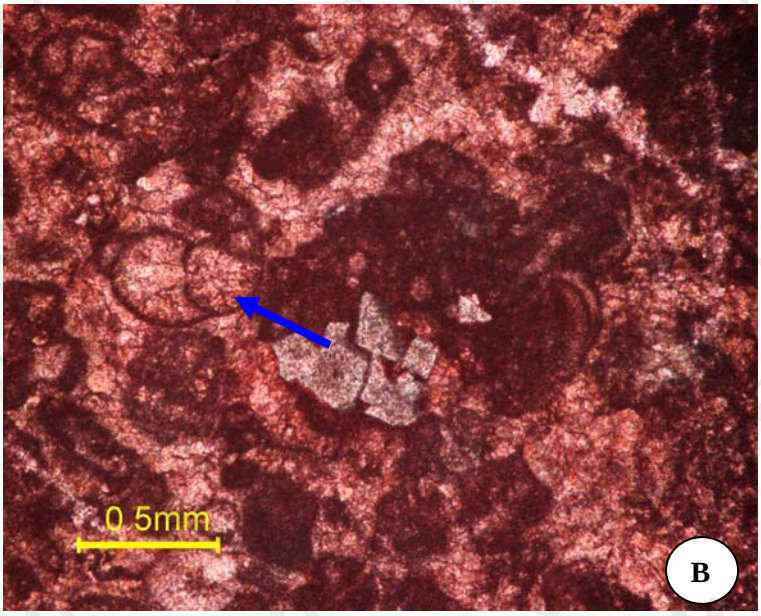


Figure 4.4 CD 1 outcrop section fauna.

A) *Eoschubertella* sp. (arrow)

B) *Biseriella parva.* (arrow)

4.3.7 The CD 2 outcrop section

The limestone in the CD 2 outcrop section is oosparite microfacies. Small foraminifera are rare and only one has been identified. This is *Climacammina* sp., which suggests a Late Carboniferous age.

4.3.8 The CD 3 outcrop section

The limestone in the CD 3 outcrop section is biosparite microfacies. The bioclasts are fusulinids, coral, and small foraminifera. These small foraminifera are *Globivalvulina* sp., *Climacammina* sp., *and Tetrataxix* sp. The fusulinids are *Pseudoschwagerina* sp. and *Triticites* sp. *Pseudoschwagerina* sp. suggests the Early Permian Asselian age and *Triticites* sp. indicates the Gzhelian of the late Late Carboniferous. These two foraminifera suggest the Carboniferous-Permian boundary is within this outcrop section (Figure 4.5).

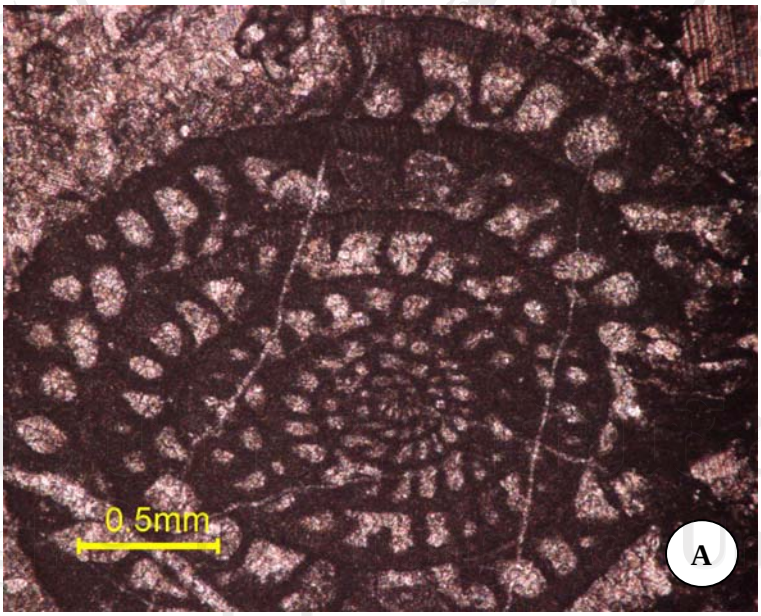


Figure 4.5 CD 3 outcrop section fauna.
A) *Triticites* sp.

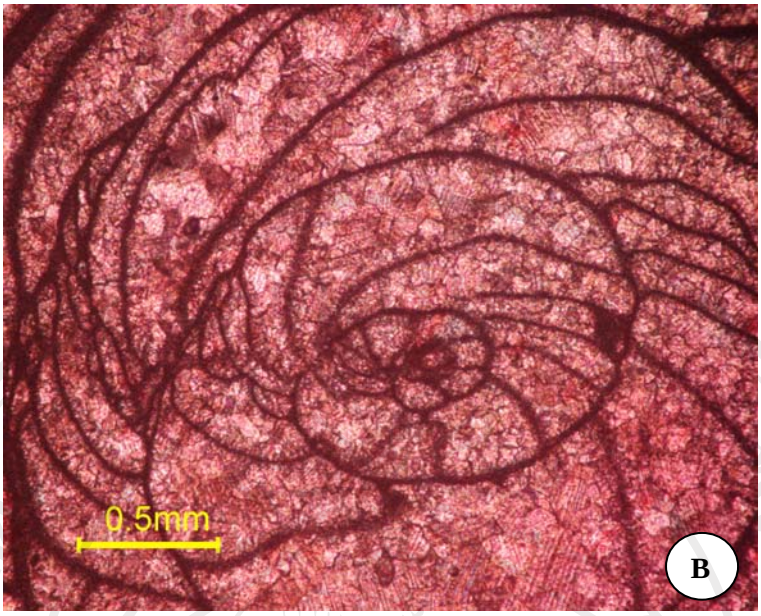


Figure 4.5 CD 3 outcrop section fauna.
B) *Pseudoschwagerina* sp.

4.4 Discussion

1) The Khao Tham Pong quarry carbonate rocks are Middle Carboniferous Moscovian in age.

2) The carbonate rocks in the CD 92, CD 4, CD 93, CD 1, and CD 2 outcrop sections are Upper Carboniferous in age.

3) The foraminifera *Pamirina (P.) darvasica* found by Ueno and Igo (1997) was not found in CD 93.1 outcrop section. The only foraminifera found in the section was *Globivalvulina* sp., which indicates a Late Carboniferous to Permian age.

4) The carbonate rocks in the CD 3 outcrop section are Carboniferous to Permian in age. The boundary between the Carboniferous and Permian should be within these rocks.