

Discovery of a Lower Devonian Dacryoconarid bed from Hill B Guar Jentik, Perlis: Its significance and implications

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Abstract: A Lower Devonian dacryoconarid bed has been found in Hill B at Guar Jentik, Perlis. This fossiliferous bed stratigraphically overlies a biomicritic limestone lenticle, also known as the Sanai Limestone member, which is located at the lower part of Hill B. The Dacryoconarid bed contains *Nowakia acuaria* and *Styliolina* sp.. *Monograptus* sp. and *Plectodonta forteyi* were also found in this layer. The occurrence of *Nowakia acuaria* and *Plectodonta forteyi* in the dacryoconarid bed indicate a late Pragian to early Emsian age. Dacryoconarids are randomly oriented and abundant at the top of the limestone overlying the dacryoconarid bed. Dacryoconarids are very rare in the middle part of the limestone. This indicates that the limestone bed at Hill B is older than Pragian. It is probably the upper part of the Setul Formation. The Devonian sequence at Hill B, which is represented by thinly bedded mudstone and the dacryoconarid bed, suggests very slow deposition or non-deposition during Middle and Late Devonian.

Abstrak: Lapisan dacryoconarid yang berusia Devon Bawah telah dijumpai di Bukit B Guar Jentik, Perlis. Lapisan kaya fosil ini secara stratigrafi menindih kekanta batu kapur biomikrit, yang terletak di bahagian bawah Bukit B. Lapisan dacryoconarid mengandungi *Nowakia acuaria* dan *Styliolina* sp. Selain daripada itu, *Monograptus* sp. dan *Plectodonta forteyi* juga dijumpai dalam lapisan ini. *Nowakia acuaria* dan *Plectodonta forteyi* adalah fosil index biostratigrafi yang penting dalam menunjukkan lapisan dacryoconarid ini berusia dari Pragian Akhir ke Emsian Awal. Dacryoconarid wujud dalam pelbagai orientasi dan banyak di bahagian atas batu kapur terutamanya di sentuhan antara batu kapur dan lapisan dacryoconarid. Dacryoconarid sangat jarang di bahagian tengah batu kapur. Ini menunjukkan lapisan batu kapur di Bukit B adalah lebih tua dari Pragian. Kemungkinan ini merupakan bahagian atas Formasi Setul. Jujukan Devon di Bukit B yang diwakili oleh lapisan nipis batu lodak dan lapisan dacryoconarid mencadangkan pengendapan yang perlahan atau tiada pengendapan semasa Devon Tengah dan Devon Akhir.

INTRODUCTION

Lower Devonian dacryoconarid beds have been reported as *Tentaculite*-beds in several parts of Thailand, Malaysia, Myanmar, and Yunnan in southwestern China (Kobayashi and Hamada, 1968). Several *Tentaculite* beds of Peninsular Malaysia were reported mainly from the black mudstone of the Mahang Formation, Kedah, and the Baling Group, north Perak (Burton, 1967), the Setul Formation of the Langkawi Islands (Jones, 1981) and the Timah Tasoh Formation (Meor Hakif and Lee, 2005). These *Tentaculite* beds contain graptolites, trilobites and brachiopods.

Meor Hakif and Lee (2005) discovered *Tentaculite* bearing black mudstone from Guar Jentik, Perlis. They assigned this bed to a new lithostratigraphic unit known as the Lalang Member of the Timah Tasoh Formation. Recently, we mapped the area and found another dacryoconarid bed overlying the limestone lenticle (Sanai Limestone Member of Meor and Lee 2003) in the area. The purpose of this paper is to highlight the new discovery and its implication on the stratigraphy of the area.

GEOLOGICAL SETTING

In the Guar Jentik area, there is a ridge locally known as Guar Sanai which consists of three small hills (guar)

tentatively called Hill A, B and C by Meor Hakif and Lee (2002). They assigned the rocks in the area to a new lithostratigraphic unit called the Jentik Formation, which ranges in age from Early Devonian to Early Carboniferous. The Jentik Formation was divided into six units. Meor Hakif and Lee (2003) described a limestone bed as a new member, the Sanai Limestone Member, of the formation. Finally, Meor Hakif and Lee (2005) have upgraded all these units into several formations i.e. the Timah Tasoh Formation, Chepor Formation, Sanai Limestone, Binjal Formation, Telaga Jatoh Formation and Wang Kelian Formation. According to the North American Stratigraphic Code (1983) Article 24 (d), "No formation is considered valid that cannot be delineated at the scale of geologic mapping practiced in the region when the formation is proposed". The scale of geological mapping normally practiced in Malaysia is 1: 25,000. Therefore, the division of the former Jentik Formation into several formations is not desirable. In this paper, we prefer to use the name Jentik Formation.

The Jentik Formation is exposed at several earth quarries in the Guar Sanai area. The formation is generally dipping eastwards and is underlain by the Setul Limestone in the west and overlain by the Chuping Limestone in the east. The rocks in the area are cut by many faults i.e.

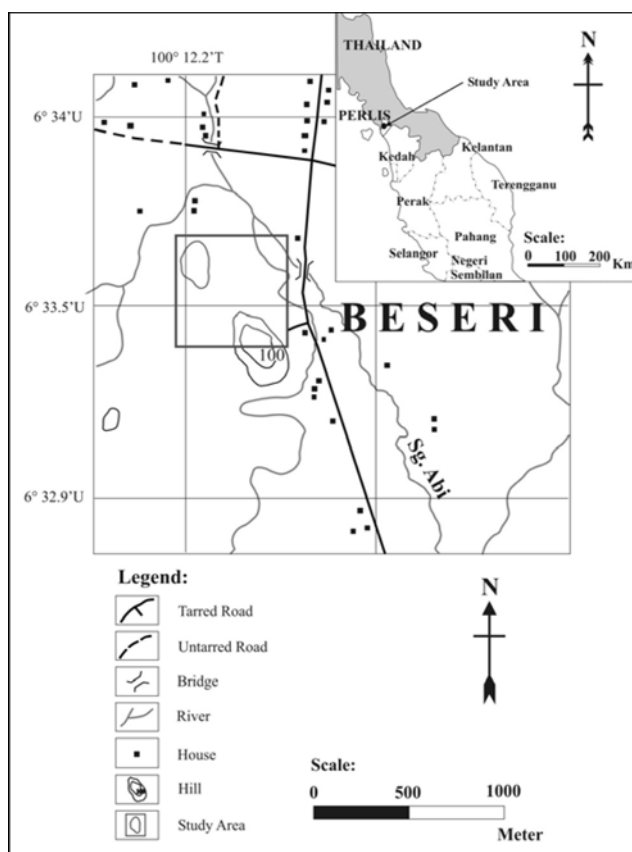


Figure 1: Map of Perlis showing locality of the study area.

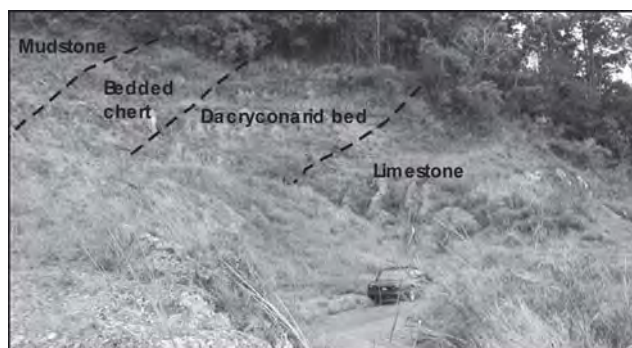


Figure 2: The outcrop of the dacryoconarid bed at the northern part of Hill B.

thrust, lateral and normal faults. There are many shear zones and mylonites observed in the area. The stratigraphy of the area is more complicated than previously thought.

Recently, we carried out mapping in the northern part of Hill B and Hill C (Figure 1). At the northern part of Hill B we discovered five lithofacies (in ascending order) i.e. the limestone, dacryoconarid mudstone, bedded chert, mudstone and fine sandstone (Figure 2). The rocks are tilted dipping northeast in normal position. No fault was observed in the area.

Rocks at Hill C are more structurally complicated. Lithofacies are recognized in ascending order, dacryoconarid black mudstone (oldest), very thinly bedded chert, sandstone, bedded chert, red mudstone, mudstone, black sandstone, interbedded sandstone and mudstone,

sandstone (youngest). A limestone bed was also observed at the eastern flank of the hill (Figure 3). Its stratigraphic position is not fully understood because of lack of fossils. The study of several thin sections suggests that the petrography of the limestone is comparable to the limestone exposed at the lower part of Hill B. Both limestones contain dacryoconarids and ostracods.

DESCRIPTION OF THE DACRYOCONARID BED AND ADJACENT ROCKS

In this study, we concentrate on the dacryoconarid bed exposed at the northern part of Hill B and compare it to the dacryoconarid bed from the lowermost part of Hill C.

The dacryoconarid bed at Hill B is approximately 4 m thick with strike and dip, $348^{\circ}/46^{\circ}$. The mudstone is highly weathered and yellow in colour. The dacryoconarids are very abundant and randomly oriented. The dacryoconarids consist of *Nowakia acuaria* and *Styliolina* sp. Other fossils found in the bed are graptolites; *Monograptus* sp. and Brachiopoda: *Plectodonta fortayi* Boucot and Cocks (Plate 1). The occurrence of *Nowakia acuaria* and *Plectodonta fortayi* is indicative of a late Pragian to early Emsian age. At the southern part of Hill B the dacryoconarid bed was not observed. Contact between the limestone and chert is marked by a fault zone. Dacryoconarids were also recorded at the top of the limestone (Meor Hakif and Lee 2003). The fossils in both dacryoconarid beds of Hill B and Hill C are essentially similar, except *Plagiolaria* sp was not discovered at Hill B. This indicates that both beds are of the same age.

The dacryoconarid bed is underlain by biomicritic limestone. Numerous dacryoconarids (nowakiids and styliolids) were observed at the top 10cm of the limestone (Figure 4). Petrographic study shows that the limestone at Hill B is very similar to the limestone at Hill C. The limestones contain skeletons of ostracods, dacryoconarids, and very rare trilobites (Figure 5). The limestone at Hill C yielded very rare dacryoconarids compared to the limestone at Hill B (Figure 6). We conclude that both limestones are of the same age. In the field, the limestone can be well correlated. This limestone is assigned as the Sanai Limestone (Meor Hakif and Lee, 2005) or the Sanai Limestone Member (Meor Hakif and Lee, 2003).

At Hill B, the chert unit (the Telaga Jatoh Formation of Meor Hakif and Lee, 2005) overlies the dacryoconarid bed and it comprises thinly bedded radiolarian chert interbedded with thinly bedded mudstone. The chert unit is folded due to slumping. The chert contains numerous poorly preserved radiolaria. We tried many times to retrieve radiolaria from the chert but failed. The chert unit is well exposed at Hill B. It is traceable southwards to the southern part of Hill B and Hill A. The age of the chert unit is not known. The most reliable age of the chert unit at the base of the Kubang Pasu Formation exposed at Bukit Binjal, Kedah is Tournaisian, Early Carboniferous (Basir Jasin and Zaiton Harun, 2001). These samples were

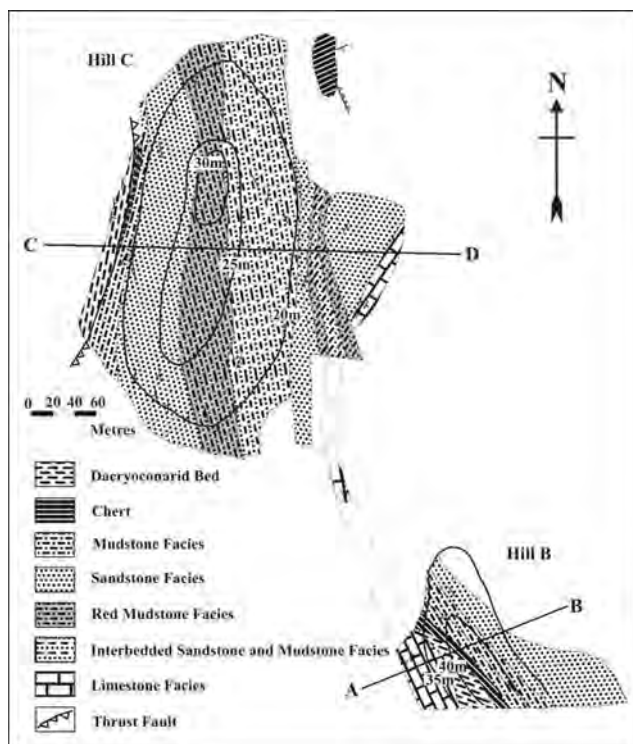


Figure 3: Geological lithofacies map of Hill C and the northern part of Hill B, exposed at Kampung Guar Jentik, Perlis.

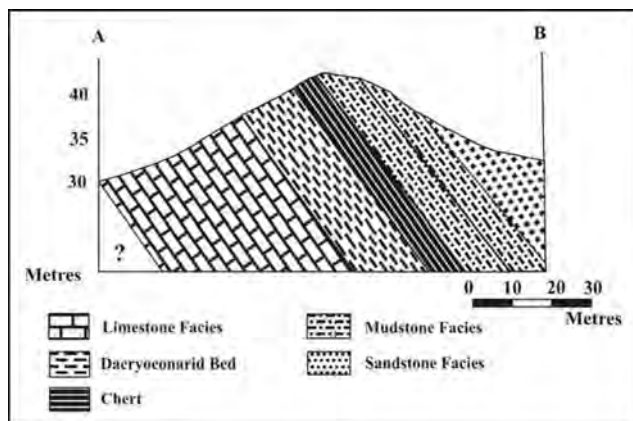


Figure 4: Cross section of the northern part of Hill B.

collected from the top of the chert unit. The age of the lower part of the chert may extend to Famennian, Late Devonian as recorded elsewhere in the Bentong-Raub Suture zone (Spiller, 2002; Basir Jasin *et al.*, 2004).

THE STRATIGRAPHIC DISTRIBUTION OF DACRYOCONARID IN SOUTHEAST ASIA

Although several species and subspecies of *Tentaculites* have been identified by Meor Hakif and Lee (2005) from the dacryoconarid bed at Hill C, we could only identify *Nowakia acuarria* and *Styliolina* sp. The present specimens are not good enough to allow proper identification at the subspecies level. The *Nowakia-Styliolina* association has been reported from Myanmar, North Vietnam, Yunnan, Thailand and Peninsular Malaysia (Kobayashi and Hamada, 1968). This association was

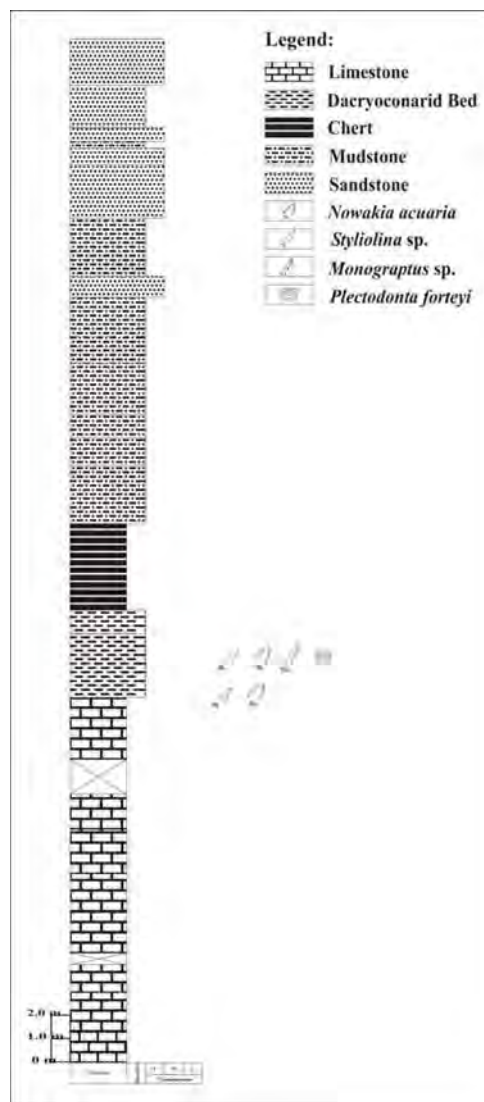


Figure 5: Logged section of the northern part of Hill B, and the position of the dacryoconarid bed.

reported ranging from Early Devonian to early Givetian, Middle Devonian (Kobayashi and Hamada, 1968). In Thailand and Peninsular Malaysia, the association was divided into four faunal units, TN1 to TN4, which range from Lockhovian, Early Devonian to Eifelian, Middle Devonian (Hamada *et al.*, 1975). There is no record of Late Devonian dacryoconarids.

GEOLOGICAL SIGNIFICANCE AND IMPLICATIONS

The dacryoconarid bed at Hill C is a stratotype for the Lang Member of the Timah Tasoh Formation identified by Meor Hakif and Lee (2005). The similarity of fossil content in the dacryoconarid beds of Hill B and Hill C indicates that both beds are of the same age. Based on the stratigraphic position of the dacryoconarid bed at Hill B, it is evident that the dacryoconarid beds at Hill C, was displaced to its present position by a thrust fault. The original position of the bed is supposed to be on top of the limestone bed, which is located at the eastern side of the

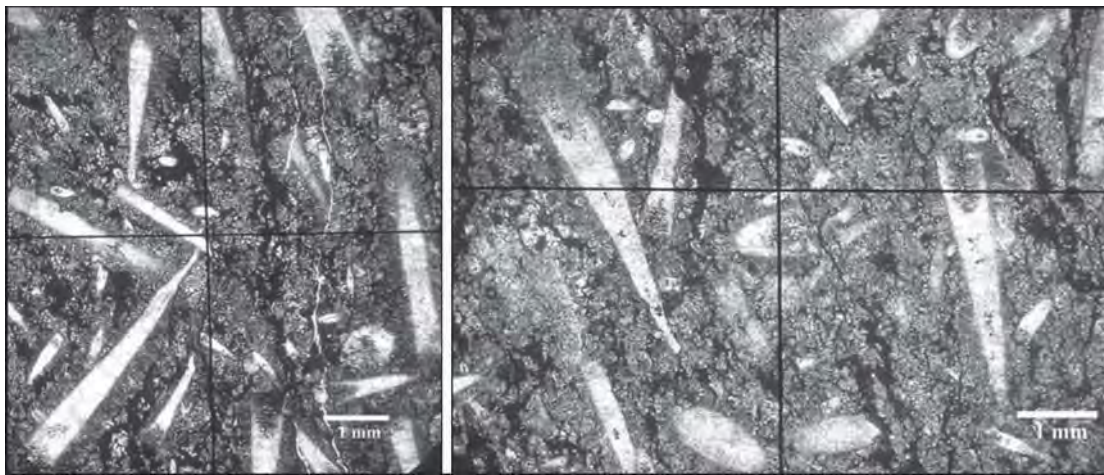


Figure 6: Thin sections of the limestone at Hill B, dactyloconarids occurred abundantly in the biomicrite limestone.

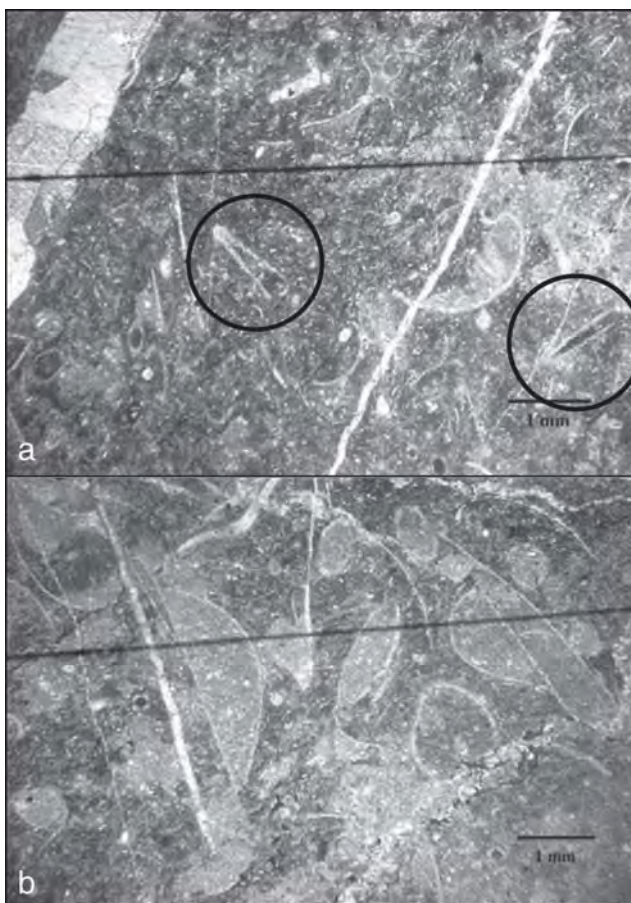


Figure 7: Thin sections of the limestone at Hill C. a: Biomicrite packed with dactyloconarids. b: Skeletons of ostracods.

hill. The stratigraphic position of the bed as the lowermost part of the Jentik Formation (Meor Hakif and Lee, 2003, 2005) is erroneous. In order to construct a lithostratigraphic unit, one must ensure that the sequence is not displaced by faults. The thrust faults are common at Hill C and can be traced at several outcrops. The proper stratigraphic position of the dactyloconarid bed is on top of the limestone bed as shown at Hill B.

Discovery of dactyloconarids at the top of the limestone bed (the Sanai Limestone of Meor Hakif and Lee, 2005)

Period	Epoch	Age	<i>Nowakia acuaria</i>	<i>Styliolina</i> sp.	<i>Monograptus</i> sp.	<i>Plagiolaria poothaii</i>	<i>Plectodonta forteyi</i>
Devonian	Late Devonian	Famennian					
		Frasnian					
	Middle Devonian	Givetian					
		Eifelian				X	
	Early Devonian	Emsian	X	X	X	X	X
		Pragian	X	X			
Lochkovian							

Figure 8: Stratigraphic distribution of fossils found in Hill B and Hill C.

at Hill B and in the limestone at Hill C provides new evidence that the limestone is older than previously reported by Meor Hakif and Lee (2003). Meor Hakif and Lee (2003) have identified two specimens of *Palmatolepis glabra* and *Palmatolepis quadrantinodosalobata*, which dated the limestone as Famennian, Late Devonian. We found the dactyloconarids lacking or very rare in the middle limestone bed and increase in abundance at the contact between the limestone and the dactyloconarid bed especially at the northern part of Hill B (Figure 7). This suggests that the dactyloconarids first made an appearance in the limestone and became more abundant in the mudstone.

At Hill C, the chert unit crops out at three localities. There is evidence, that the chert was displaced due to thrust faulting. The stratigraphic position of the chert unit at Hill C is not reliable for lithostratigraphy. The geological map of Hill C by Meor Hakif and Lee (2003) is oversimplified and the chert unit and the limestone bed were excluded. The chert unit is portrayed in Figure 3.

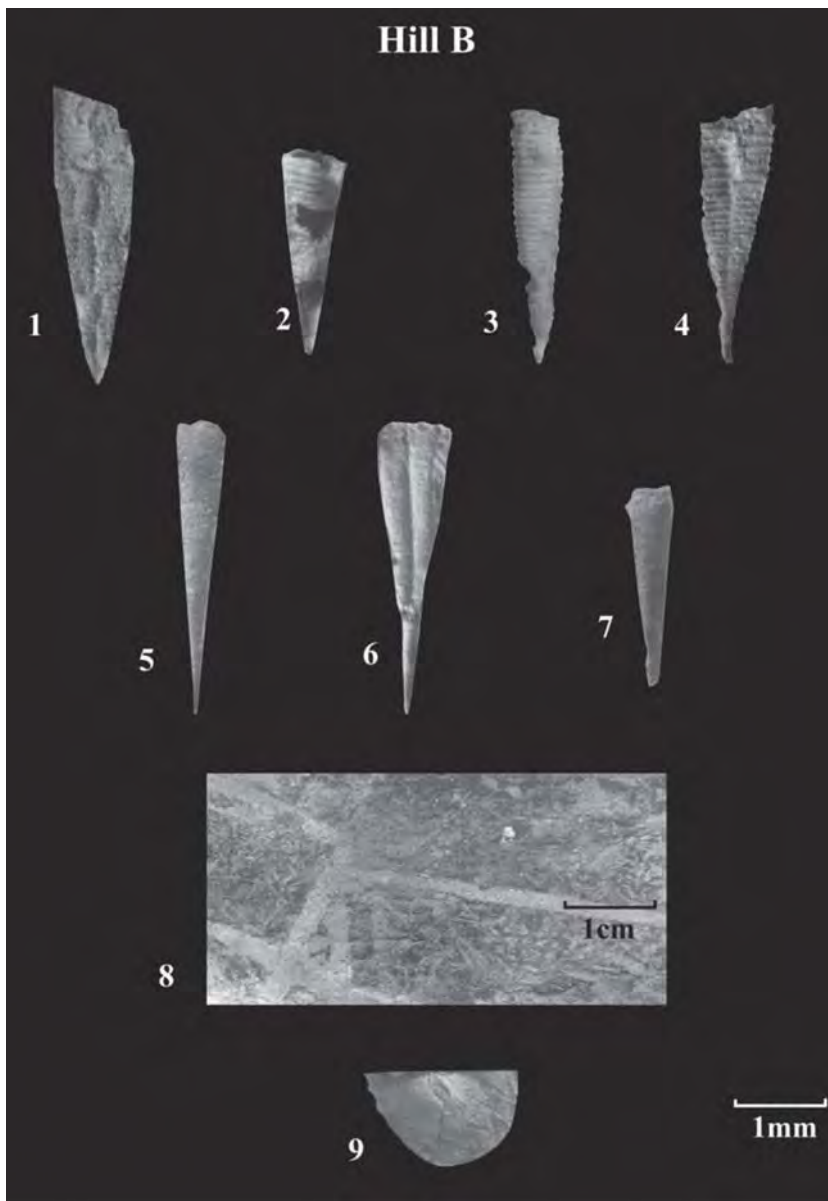


Plate 1: Fossil assemblage from the dacryoconarid bed. 1, 2, 3 and 4. *Nowakia acuaria*; 5, 6, and 7. *Styliolina* sp.; 8. *Monograptus* sp.; 9. *Plectodonta forteyi* Boucot and Cocks.

The lower part of the Hill C sequence comprises (in ascending order) dacryoconarid black mudstone, mylonite, a deformed black chert unit, fine sandstone and another chert unit. Two chert beds were observed at the Hill C. The sequence is partly similar to the rock sequence at Hill B where the chert unit overlies the dacryoconarid bed.

CONCLUSIONS

The abundance of dacryoconarid tentaculites in the limestone at the contact of the limestone and the dacryoconarid bed and the stratigraphic position of the rocks at Hill B suggest that the limestone is older than Famennian. The occurrence of *Palmatolepis glabra* and *Palmatolepis quadrantinodosalobata* is now problematic. Based on the age of the dacryoconarid bed we reckon that the limestone is older than Pragian. It is probably representing the upper part of the Setul Formation. The

rock sequence at Hill B is comparable to the one at Teluk Mempelam, Pulau Langgun. The rock sequence at Guar Jentik is not comparable to the Pa Samed Formation in Thailand.

The lithostratigraphy at Hill C is structurally complicated, due to displacement by thrust faults. It is not advisable to construct a geological stratigraphic map by just considering the sequence found in Hill C. The rock sequence at the northern area of Hill B shows the proper stratigraphic position of the lower part of the Jentik Formation.

The Devonian sequence at Hill B is represented entirely by mudstone and the dacryoconarid bed. This suggests very slow deposition or non-deposition during the Middle and Late Devonian. The deposition continued with the chert unit, which was probably laid down during the Tournaisian, Early Carboniferous.

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