

Comparison of the Fossiliferous Middle Devonian units in Pyinoolwin Township and Northern Shan State

Khaing Khaing San¹, Si Si Mar² & Zar Ni Swe³

Abstract

Four occurrences of fossiliferous units (two new discovered) of Middle Devonian age in Padaukpin area and Pwepon area in Pyinoolwin Township and Lashio area and Hsipaw area in Northern Shan State provide an insight into changing lithology and faunal occurrences. The Padaukpin Limestone is a fossiliferous argillaceous limestone within the Maymyo Formation exposed in Wetwun –Padaukpin area, Pyinoolwin Township, where specimens of corals and brachiopods dominate mega fauna, foraminifera and conodont. Next occurrence of Padaukpin Limestone recognized in Lashio area, Northern Shan State. It exposed as an isolated outcrops of only one locality in this area. The unit mainly composed of calcitic limestone and argillaceous limestone with recrystallized gastropods, crinoids, brachiopods and abundant rugose and tabulate corals. A slighter younger coral dominated fauna assemblage, exposed during excavations at Pwepon area, Pyinoolwin Township is the occurrence of Middle Devonian fossiliferous limestone, recorded in that area and is assigned to the Pwepon Limestone of the Maymyo Formation. Another occurrence of Pwepon Limestone continuously exposed along Mandalay – Lashio car-road mile post (156/3) in Hsipaw area contains a diverse rugose coral fauna representing an in situ assemblage of complete and unfragmented specimens. Fossils recorded from this area are abundant rugose and tabulate corals and numerous brachiopods. Therefore, the fossil dated Middle Devonian unit is not limitedly exposed which is widely distributed unit in Pyinoolwin Township and Northern Shan State.

Keywords: Middle Devonian, Padaukpin Limestone, Pwepon Limestone

Introduction

The Padaukpin Limestone has previously been placed in the lower part of the Plateau Limestone (lower dolomitic part) of Devonian age (Reed, 1908&1929;La Touche,1913), the Shan Dolomite of Devonian age (Brunnschweiler,1970), and the lower division of the dolomitic part of the Plateau Limestone (Anderson *et al.*, 1969) and the Maymyo Dolomite Formation (Amos, 1975). Aye Ko Aung (2001) proposed, on the faunal basis that the Wetwin Shale and the Padaukpin Limestone were considered as the member ranks to be included in the Maymyo Formation. The type section is located near Padaukpin village about 1.6km ESE of the Wetwin railway station on the Mandalay-Lashio track.

Khaing Khaing San (2005) pointed out that Padaukpin Limestone and Wetwin Shale are not designated as Member rank. They are merely the fossiliferous sandwiched units of the Maymyo Formation which escaped from the dolomitization process. Wetwin Shale is not exposed in Lashio and Hsipaw area. These two fossiliferous limestone of the Padaukpin Limestone and the Pwepon Limestone outcrops in Pyinoolwin Township located away a distance of 48 km in NNE-SSW direction and 57 km in NE-SW direction of Lashio and Hsipaw area (Figure 1).

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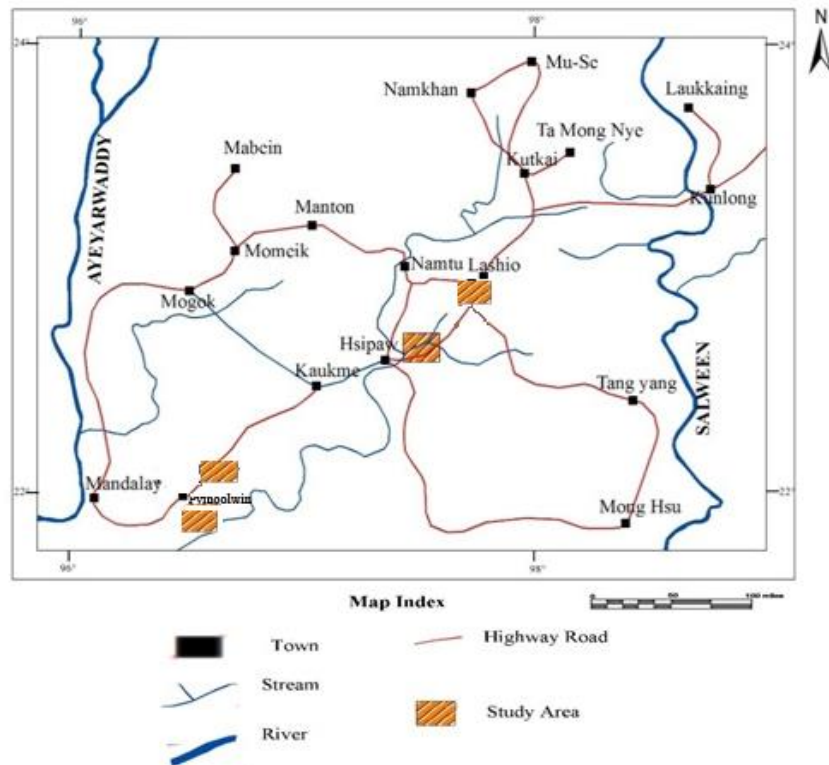


Figure (1). Location map of the study area.

Previous Works

Various geologic investigations were made by many geologists in Wetwun-Padaukpin area due to its accessibilities and some well-known stratigraphic units such as the Padaukpin Limestone and Wetwin Shale. The previous works of La Touche (1913), Chhibber (1934), Pascoe (1959), Maung Thein and Ba Than Haq (1969), Thaw Tint (1969, 1972), Amos (1975), I.G.C.P. (1980), Bender (1983), Wolfart *et. al.* (1984) and Aye Ko Aung (2004, 2012) are distinctly well remarkable in the stratigraphy of the northern Shan State. From the paleontological point of view, Reed (1908, 1929), Anderson *et. al.* (1969), Aye Ko Aung (1995), Khaing Khaing San (2001, 2005) and Khaing Khaing San and Aye Ko Aung (2004) and Khaing Khaing San (2006) described and illustrated the fossils from the Padaukpin Limestone.

Particular attention was paid to the Pwepon area by many geologic workers because of its economic importance of the occurrences of iron ore (Noetling, 1891; La Touche, 1913; Krupp, 1961, 1962). Win Win Kyi (1990) emphasized the Geology and Mineral Resources of the Pathin-Kyadwinye area. Aye Ko Aung (1995) described new Middle Devonian (Eifelian) rugose corals from the Pwepon area. Khaing Khaing San (2005) systematically described the rugose corals from the Pwepon Limestone.

Tin Myo Myo Htwe, Hla Hla Htay and Nu Nu Yin (2003) and Zaw Win (2010) investigated Lashio area for their MSc and MRes dissertation. MSc students from Geology department of Lashio University also studied the stratigraphy, paleontology and petrography of this environ of the Lashio area. Khin San (2010) had done the work on the Hsipaw-Bawgyo Area, Northern Shan State for her PhD disseration and Cho Cho Lwin (2002) & Zin

Mg Mg Thein (2002) studied the geology and stratigraphy of the Hsipaw – Bawgyo Area for their M.Sc dissertation.

Results

Occurrences of Middle Devonian Unit

Padaukpin Limestone

The Padaukpin Limestone is a fossiliferous argillaceous limestone within the Maymyo Formation exposed in Wetwun –Padaukpin area, Pyinoolwin Township. Next occurrence of Padaukpin Limestone recognized in Lashio area, Northern Shan State. It exposed as an isolated outcrops of only one locality in this area.

Padaukpin Area

Location - The Padaukpin area in Pyinoolwin Township has long been famous. It is situated about 21 km northeast of Pyinoolwin, Mandalay Region. It lies between the latitude 22° 5' N to 22°7'N and longitudes 96°35' E to 96°38' E in one-inch topographic map 93 B/12 (Figure 1).

Distribution of Outcrop – In this area, Padaukpin Limestone is exposed as the discontinuous three segments trending in NNW- SSE direction. The fossil bearing limestone and shale are locally developed at three localities in the vicinity of Padaukpin village from north to south: Locality (1) at Koesutaung pagoda (PDP-A) 22° 06' 35.7" N latitude, 96° 37' 3.7" E longitude, Locality (2) at a few kilometer northeast of Padaukpin village (PDP-B) 22° 06' 2.7" N latitude, 96° 37' 11.4" E longitude and Locality (3) at near the entrance of Peikchinmyaung cave (PDP-C) 22° 06' 16.6" N latitude, 96° 37' 8.7" E longitude (Figure 2).

Lithology - The most measurable section for Padaukpin Limestone is chosen and the well-exposed sections are taken for detailed measurements. The Padaukpin Limestone is lithostratigraphically classified into eight subunits namely ferruginous limestone, ferruginous oncoidal limestone, intraclastic limestone, argillaceous limestone, fossiliferous argillaceous limestone (Figure 4), shale or mudstone and micritic limestone, fossiliferous micritic limestone with chert nodules (Figure 3).

These limestones are mostly thin– to medium–bedded, grey to black in weathered surface. Ferruginous materials such as hematite also occurred along the fracture or joint planes of the lime-dominant unit. The iron bearing limestone or ferruginous micrite is regarded as the basal unit of the Padaukpin Limestone.

In some places, where shale or argillaceous materials are dominant, they are fossiliferous, argillaceous limestone and shale usually associated with yellow, soft and loose clay particles. Loose brachiopods and some corals are easily extracted from the soft yellow muddy horizon. The upper most unit of the Padaukpin Limestone is regarded as the micritic limestone with chert nodules. These nodules are formed by silicifications process (neomorphism). The measured thickness of the Padaukpin Limestone is 72m.

Relationship and boundary criteria: The basal unit of the Padaukpin Limestone is distinctly or sharply in contact with the highly brecciated dolomite of the "Maymyo Formation" and the upper most unit is also conformably overlain the dolomitic limestone of the "Maymyo Formation". It also appears to pass laterally into dolomite.



Figure (2). The extent of the Padaukpin Limestone with three coral biozones.



Figure (3). Medium-bedded, grey to dark grey, fossil bearing limestone containing large, solitary rugose corals of the Padaukpin area (Grid 184 789).

Figure (4). Medium-bedded, buff-coloured argillaceous limestone of the Padaukpin area (Grid 182 792).

Figure (5). Thin to medium bedded, buff to yellowish brown, highly jointed sandy limestone intercalated with black shale in the upper part of the Padaukpin Limestone in Lashio area (N 22° 54' 08" and E 97° 42' 06").

Figure (6). Medium-bedded, grey to buff, argillaceous limestone with abundant in situ tabulate corals of the upper part of the Padaukpin Limestone in Lashio area.

Fauna - Rugose coral: *Calceola sandalina*, *Cystiphyllodes asymmetricus*, *Cystiphyllodes* sp., *Puanophyllum gigantum*, *P. myanmarium*, *Catactotoechus freilingensis*, *Stingophyllum* (*Neospongophyllum*) *presepimentum*, *Disphyllum rhopaloidium*, *Spinophyllum concavum*, *S. tabulatum*, *Temnophyllum pyinoolwinensis*, *Phillipsastrea hlawaii*, *Macgeea fossulata*, *M. birmanicum*, *M. bathycaly* × *bathycaly* ×, *Thamnophyllum padaukpinensis*, *Heliophyllum* sp., *Cyathophyllum winwinkyiae*, *Peripaedium minutum*, *P. crassum*, *P. cylindricum*, and Reed's description (1908, 1929) of *Cyathophyllum ceratites*, *C. ceratites* var. *marginatum*, *C. dianthus* cf. *quadrigeminum*, *C. (Blothrophyllum)* sp., *Zaphrentis* aff. *cornicula*, *Z.* sp. indet, *Amplexus hercynicus*, *Hallia striata*, *H. callosa*, *H. quadripartita*, *Aulacophyllum looghiense*, *Cystiphyllum cristatum*, *Microplasma fractum*, *Phillipsastrea padaukpinensis*, *Endophyllum* sp. cf. *E. priscum*.

Tabulate corals: *Favosites* sp., *Coenites* sp., *Alveolites* sp., *Aulocystic* sp.

Brachiopods : *Athyris* sp. cf. *A. spiriferoides*, *Camarotoechia* sp, *Chonetes subcancellata*, *Lingula* sp.

Bryozoans : *Fenestella polyporata*, *F. wetwinensis*, *Polypora* sp.

Lamellibranchiata : *Janeia birmanica*, *Nucula* sp., *Paleoneilo* sp, *Paracyclus* sp. cf. *P. provia*, *P.* sp. cf. *P. rugosa*, *Pthoria* sp., *Prothyris* sp.

Gastropods : *Bellerophon shanensis*, *B.* sp.

Trilobites : *Prionopeltis* sp. cf. *P. cyclurus*

Lashio area

Location - Lashio area is located between the north latitude 22°52'-22°56' and East longitude 97°38'–97°48'. The study area occupied 2297 9/13UTM topographic map (Figure 1). This area is readily accessible by automobile or train throughout the whole year.

Distribution - Padaukpin Limestone is mainly exposed in the south western part of the Lashio area. Good exposures occur at the mile post 5-6 furlong of the Mandalay-Muse highway road and the quarry in the northern part of the Lashio to Hseing Khai car road (N22°53'36" and E96°40'50").

Lithology - The Padaukpin Limestone is limitedly exposed in this area and the occurrence of the Padaukpin Limestone is slightly different from the type section. The lower part is medium- to thick-bedded, light grey to buff, argillaceous limestone containing abundant crinoids stems and few small brachiopods. The upper part is mainly composed of well-bedded; light grey to grey limestone and argillaceous limestone interbedded with thin-bedded, buff colored shale and claystone-mudstone (Figure 5). containing abundant tabulate and rugose corals. In some places, where shale or argillaceous materials are dominant, fossils fragments are abundantly occurred and easily extracted from this unit (Figure 6). This unit is continuously exposed along Lashio-Muse car-road and 25 meter in thickness.

Fauna - The fauna collected from the Padaukpin Limestone are Rugosa (*Calceola sandalina*, *Temnophyllum pyinoolwinensis*., *Macgeea maniseptata*, *Cyathophyllum winwinkyiae*, *Peripaedium minutum*, *Stringophyllum* sp. A,B&C, *Enallophrentis* sp., *Gurichiphyllum* sp., *Grypophyllum* sp., *Acanthophyllum* sp. ; Tabulata (*Favosites goldfusi*, *Alveolites suborbicularis*, *Alveolites* aff. *expatiate*, *Alveolites illusa*, *Coenites escharoides*, *Alocystis conigera* ; Gastropods (*Loxonema* sp., *Euomphalus* sp., *Murchisonia* sp.) and Brachiopods (*Indospirifer* sp., *Mesodouvillina* sp., *Devonaria* sp.)

Age - According to the stratigraphic position and the distribution of the fossils, the age of the Padaukpin Limestone in these two areas can properly be assigned to Eifelian. The comparison of the Middle Devonian unit in Padaukpin area and Lashio area is shown in Table 1.

Table (1). Comparison of the Middle Devonian unit in Padaukpin area and Lashio area.

Padaukpin Limestone	
Padaukpin Area	Lashio Area
➤ Few occurrence of gastropods	➤ Abundant of recrystallized gastropods
➤ Abundant of brachiopods & bryozoans	➤ Few occurrence of brachiopods and bryozoans
➤ Abundant colonial rugose corals, i.e. <i>Phillipsastrea</i> , <i>Thamnophyllum</i>	➤ Few colonial rugose coral and absence of <i>Phillipsastrea</i> & <i>Thamnophyllum</i>
➤ Less complete section	➤ Complete section and more abundant corals

Pwepon Limestone

A slighter younger coral dominated fauna assemblage, exposed during excavations at Pwepon area, Pyinoolwin Township is the occurrence of Middle Devonian fossiliferous limestone, recorded in that area and is assigned to the Pwepon Limestone. Another occurrence of Pwepon Limestone continuously exposed along Mandalay – Lashio car-road mile post (156/3) in Hsipaw area contains a diverse rugose coral fauna representing an in situ assemblage of complete and unfragmented specimens. Fossils recorded from this area are abundant rugose and tabulate corals and numerous brachiopods.

Pwepon area

Location - The Pwepon area is located about 5 miles SE of Pyinoolwin which lies between latitudes 21° 53' N to 22° 0' N and longitudes 96° 30' E to 96° 35' E. It occupies the northern part of one-inch topographic map 93 C/9. The coral bearing limestone is situated at the Pwepon cave and its environ and has the coordinates of N21° 53' E96° 33'.

Distribution: The unit is restricted to expose in northern Shan State. In Pwepon area, it is well exposed in Pwepon cave and its environ, 3473 ft. hill at the eastern part of the Pwepon cave and smooth, isolated hill (3200 ft.) at the western part of Pwepon cave (Figure 7).

The longitudinal fault (Pwepon fault) running nearly N-S direction divides the Pwepon Limestone and Black Shale unit into the eastern and western part. It is characterized the dislocation of these two units in this area. In the eastern part of the fault, the Pwepon hill (included the Pwepon cave) is a range of two continuous hills with gentle slopes along the strike direction and its topography is very different from the neighborhoods by isolated hills of well-bedded character. In the western part of this fault, the lithology is exposed in small hill with gentle slope (3200 ft).

Lithology: The Pwepon Limestone is well-bedded, hard, micritic limestone and difficult to struck with hammer. It can be easily struck with hammer and giving the thin layers of small chips when the limestone has been subjected by weathering process. Lithologically, Pwepon Limestone is classified into eight subunits namely dolomitic

limestone, micritic limestone, argillaceous limestone, stromatolitic limestone(Figure 9), limestone intercalated with crinoidal limestone (Figure 8), argillaceous limestone intercalated with silty shale or mud(Figure 11), micritic limestone with parallel lamination and silt partings (Figure 10)and limestone with chert nodules. The total thickness of the Pwepon Limestone is 174 meters.

Relationship and boundary criteria: The boundary of the black shale and the Pwepon Limestone is clearly observed with the interval of limestone and shale interbedded unit. It is conformably underlain by the Black Shale with the gradational contact. It is overlain by dolomitic limestone with relict fossils.

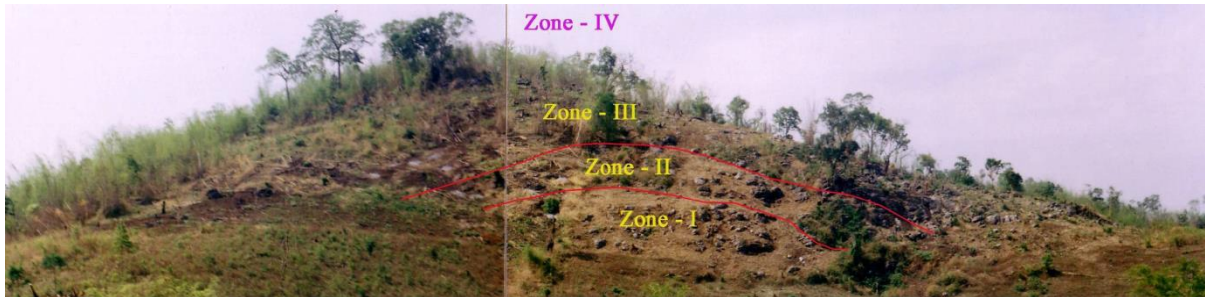


Figure (7). The outcrop nature of the Pwepon Limestone showing the Coral Biozones.

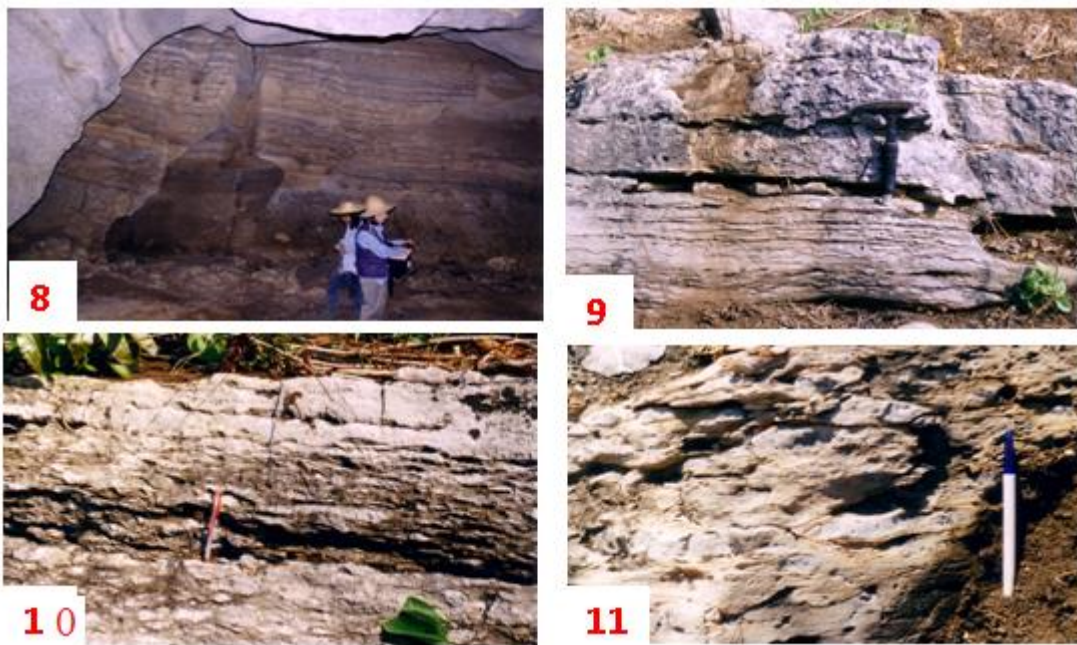


Figure (8). Argillaceous limestone interbedded with fossiliferous limestone layers showing parallel lamination in the Pwepon cave (Grid 133 544).

Figure (9). Well-bedded, light grey to grey, fine-grained calcareous limestone contained fossils and algal lamination (Grid 152 545).

Figure (10). Medium-bedded, light grey to buff-colored argillaceous limestone with distinct nodular structure of the Pwepon Limestone (Grid 152 545).

Figure (11). Argillaceous limestone with lenticular silty micrite (Grid 152 545)

Fauna: The Pwepon Limestone is richly fossiliferous.

Rugose coral : *Puanophyllum gigantum*, *P. myanmari*, *Metrionaxon sinanense*, *Catactotoechus freilingensis*, *Acanthophyllum typicaum*, *Dohmophyllum shanensis*, *Grypophyllum* sp, *Disphyllum caespitosum*, *D. dispar*, *Argutastrea pweponensis*, *Temnophyllum creber*, *T. minimum*, *Hexagonaria carinata*, *Phillipsastrea hlawaii*, *Macgeea bathycalyx bathyclayx*, *M. eifeliana*, *Cyathophyllum winwinkyiae*, *C. gigantum* .

The other fossils are the abundant tabulate corals (*Alveolites* sp., *Coenites* sp.), bryozoans, branchipods and conodonts.

Hsipaw Area

Location - The study area, located in Hsipaw Township is bounded by north latitude 22°36'48" to 22°42'12" and East Longitude 97°24' to 97°32'20" in UTM map no. 2297 (6 - 10). It is about 5 miles long in the north-south direction and 11.18 miles wide in the east-west direction, approximately covering 55.35 square miles. Mandalay – Lashio highway road runs across the study area from southwest to northeast. It can be accessible by car or train in all seasons.

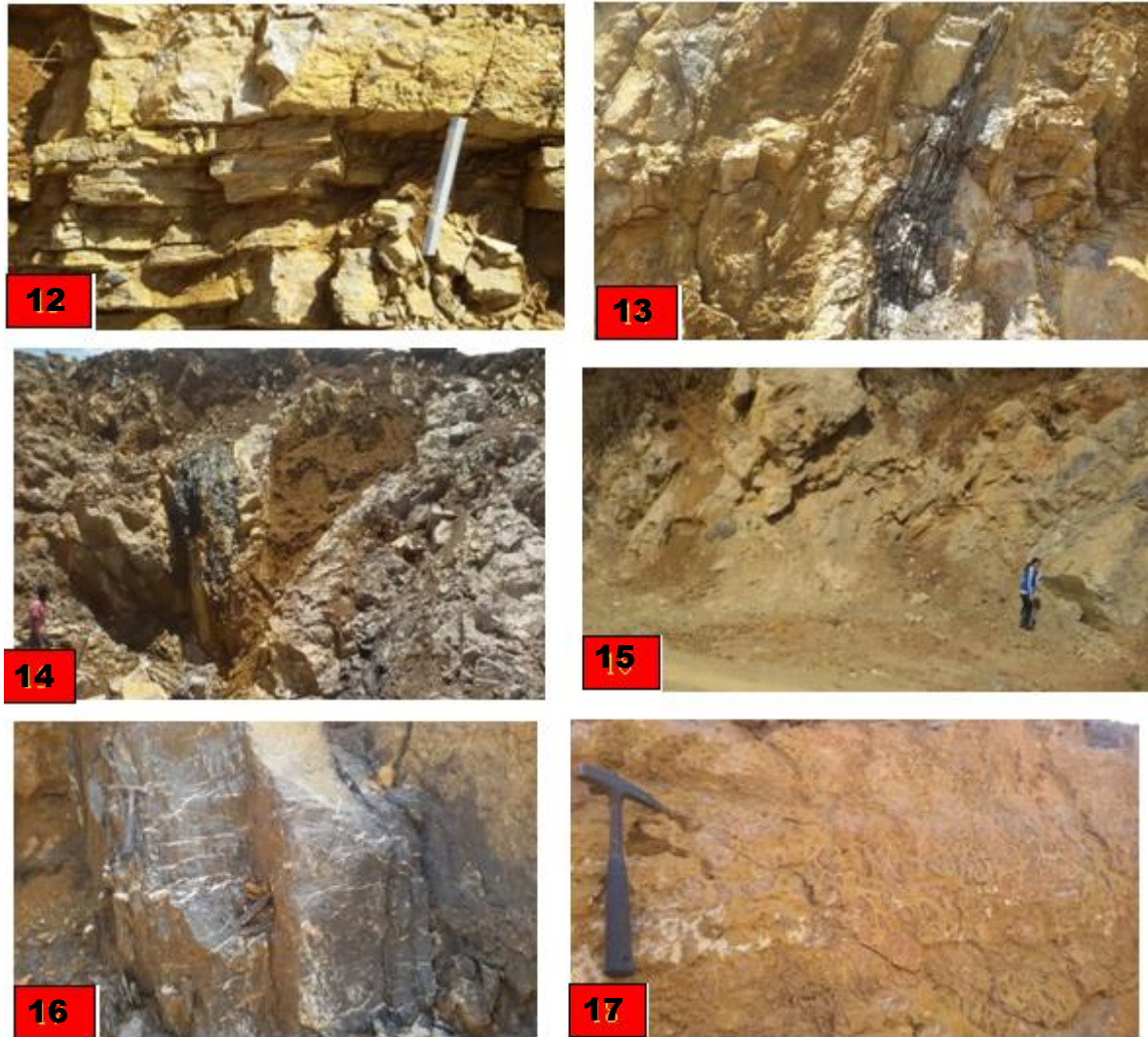
Stratigraphy - In the study area, Pwepon Limestone is mainly exposed in the south western part. The best exposures of Pwepon Limestones occur the road cut section at the mile post (156/5) of the Mandalay-Lashio car – road (N22°53'36" and E96°40'50").

The Pwepon Limestone is the sandwiched unit of the Maymyo Formation which laterally passed into dolomite or dolomitic limestone. It is the escaped unit of the dolomitization. It consists of thin- to medium-bedded, buff colour, grey to black, fine- to medium-grained, soft and indurated limestone, calcareous limestone, argillaceous limestone, carbonaceous shale and grey shale (Figures 12-17). Where shale or argillaceous materials is dominated, fossils fragments (Corals and Brachiopods) are most abundantly occurred and easily extracted from this unit. This unit is continuously exposed along Mandalay – Lashio car-road mile post (156/3) and (62) meter in thickness.

Fauna - This Limestone is the fossiliferous unit containing a number of rugose (*Temnophyllum pyinoolwinensis*, *Temnophyllum creber*, *Temnophyllum minimum*, *Macgeea birmanicum*, *Macgeea bathycalyx*, *Macgeea eifeliana*, *Stringophyllum* sp., *Gurichiphyllum* sp., *Grypophyllum* sp., *Argutastrea* sp.; tabulate corals (*Favosite goldfusi*, *Alveolites suborbicularis*, *Alveolites* aff. *expatiate*, *Alveolites illusa*, *Coenites escharoides*, *Alocystis conigera*; , brachiopods (*Spinatrypa* sp., *Uncinulus* sp., *Desquamatia* sp., *Reticulariopsis eifiensis*, *Athyris* sp., *Xystrostrophia* sp, *Strophomena* sp., *Atrypa* sp., *Markitoechia* sp. and crinoids.

Age - The occurrence of above faunal assemblage indicates that the age of the Pwepon Limestone in these two areas can properly be designated as the Middle Devonian (Eifelian to Givetian) age.

The comparison of the Middle Devonian unit in Padaukpin area and Hsipaw area is shown in Table (2).



- Figure (12). Thin- to medium- bedded, light grey to buff colour, argillaceous limestone in the lower part of the Pwepon Limestone (N 22° 37' 32" and E 97° 25' 10").
- Figure (13). Thin- to medium-bedded, yellowish to buff colour argillaceous limestone intercalated with carbonaceous shale in the lower part of the Pwepon Limestone (N 22° 37' 36" and E 97° 25' 51").
- Figure (14). Medium-bedded, dark grey to black carbonaceous limestone intercalated with grey shale in the middle part of the Pwepon Limestone (N 22° 37' 38" and E 97° 25' 19").
- Figure (15). Medium- to thick-bedded, grey to buff colored argillaceous limestone and calcitic limestone intercalated with the thinly bedded carbonaceous shale of the middle part of Pwepon Limestone (N 22° 37' 48" and E 97° 25' 29").
- Figure (16). Medium- to thick-bedded, grey to dark grey calcareous limestone with abundant calcite veins in the upper part of the Pwepon Limestone (N 22° 37' 41" and E 97° 25' 16").
- Figure (17). Medium-bedded, dark grey limestone with iron stained mud cracks on the bedding plane of the upper most part of the Pwepon Limestone (N 22° 37' 50" and E 97° 25' 41").

Table (2). Comparison of the Middle Devonian unit in Pwepon area and Hsipaw area.

Pwepon Limestone	
Pwepon Area	Hsipaw Area
➤ More calcitic	➤ More agrillaceous
➤ Few occurrence of brachiopods	➤ Abundant of brachiopods
➤ Few colonial rugose coral and smaller corallum	➤ Abundant colonial rugose corals and larger corallum
➤ Less complete section	➤ Complete section and more abundant solitary coral and larger size of corals
➤ More conical form	➤ More cylindrical form
➤ Occur as talus	➤ Occur as growth position

Discussion

Fossils dated Middle Devonian units are previously described as limitedly exposed unit in Myanmar such as Wetwin-Padaukpin and Pwepon. The Lashio and Hsipaw area are the new occurrences of Middle Devonian unit which previously described as Triassic Nwabangyi Dolomite Formation in northern Shan State as well as in Myanmar. The other localities of the probable Middle Devonian unit are near Hkai Hsin, to within 25 km of the Yadanatheingyi area (Mitchell et al, 1977), W of Lokelaung village, Naungcho township (Aye Ko Aung, 1979), near Kyaukkhwet village (personal communication with U Aung Moug, Lecturer, D.S.T.U.) and the Leikkya-Thandaung area (personal communication with U Thet Naing, Lecturer, Geology Department, Mandalay University). Very recently, the first occurrence of the Padaukpin Limestone equivalent unit in northern Shan State occur in Hopang area, Wa Self-Administered Division in eastern part of Thanlwin River (personal communication with Dr. Zar Ni Swe, Lecturer, Geology Department, Yadanabon University).

The correlation of the previously described Middle Devonian rugose coral genus in different area is shown in Table 3. The systematic description of the rugose corals from Padaukpin Limestone and Pwepon Limestone pointed out that they have the close affinities with Europe, South China and Australia. According to the stratigraphic position and the distribution of the fossils, the age of the Padaukpin Limestone is Eifelian and the age of the Pwepon Limestone ranges from Eifelian to Givetian.

The Padaukpin Limestone in Padaukpin area, rugose corals and brachiopods attain larger sizes and greater specific and generic diversity suggests the quiet and semi-restricted lagoonal biofacies (Shelf – lagoon open circulation). Massive corals mainly developed in shallow water, high-energy environments. The faunal and sedimentary characters of Padaukpin Limestone in Lashio area also pointed out the shallow water, quiet, stable muddy shelf condition.

Most of the rugose corals in Pwepon area are incompletely preserved, solitary are common, massive forms are second and the fasciculate forms are less common than the former two. So, they lived on the margin of the carbonate platform adjacent to a water basin and were destroyed and easily transported by the high wave energy along the gentle slope, and quickly deposited in the middle parts of the platform with a calm water environment

Table (3). Correlation of the previously described Middle Devonian rugose coral genus in different area.

No	described rugose corals from Myanmar	Padaukpin area (Khaing Khaing San, 2005)	Pwepon area (Khaing Khaing San, 2005)	Lashio area (Khaing Khaing San <i>et al</i> , 2017)	Hsipaw area (Khaing Khaing San <i>et al</i> , 2018)
1	<i>Calceola</i>	√		√	
2	<i>Cystiphyllodes</i>	√			
3	<i>Puanophyllum</i>	√	√		
4	<i>Metrionaxon</i>		√		
5	<i>Catactotoechus</i>	√	√		
6	<i>Acanthophyllum</i>		√	√	
7	<i>Dohmophyllum</i>		√		
8	<i>Grypophyllum</i>		√	√	√
9	<i>Strigophyllum</i>	√		√	√
10	<i>Disphyllum</i>	√	√		
11	<i>Argutastrea</i>		√		√
12	<i>Spinophyllum</i>	√			
13	<i>Temnophyllum</i>	√	√	√	√
14	<i>Hexagonaria</i>		√		
15	<i>Phillipsastrea</i>	√	√		
16	<i>Macgeea</i>	√	√	√	√
17	<i>Thamnophyllum</i>	√			
18	<i>Heliophyllum</i>	√			
19	<i>Cyathophyllum</i>	√	√	√	√
20	<i>Peripaedium</i>	√	√	√	
21	<i>Enallophrentis</i>			√	
22	<i>Gurichiphyllum</i>			√	

of shelf lagoon open circulation. The unit becomes more calcareous in Hsipaw area. The faunal and sedimentary characters pointed out that shallow water, quiet, stable muddy shelf condition.

Conclusion

It can be concluded that Middle Devonian unit is not limitedly exposed which are widely distributed unit in Myanmar. It is the paired occurrence of Eifelian (Padaukpin Limestone) and Eifelian-Givetian (Pwepon Limestone) in Pyinoolwin Township and Northern Shan State. So, it can suggest that the next paired occurrence of Middle Devonian unit may be in Kyaukme and Naungcho area. It must need to reinvestigate the stratigraphy and paleontology of the Triassic Nwabangyi dolomite Formation in northern and southern Shan State. Some may be the Middle Devonian unit.

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