

## Stratigraphy of the Rock Units Exposed in Taungkyun Area, Pyin Oo Lwin Township, Mandalay Region

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### Abstract

The Taungkyun area is situated in Pyin Oo Lwin Township, Mandalay Region. The Paleozoic strata are exposed in the study area. They are generally trending nearly N-S direction and dipping toward the east. The rock units exposed in the study area are the Sitha Formation, the Kunlein Formation, the Nyaungbaw Formation, the Zebingyi Formation, and the Plateau Limestone Group. The Sitha Formation comprises stromatolites and biogenic laminated structures. The age of the Sitha Formation is regarded as the Middle Ordovician age on the basis of stratigraphic position and lithologic characters. The age of the Kunlein Formation is regarded as Late Ordovician by comparing the presence of the abundant brachiopods, echinoderms and biogenic structures (trace fossils or ichnofossil) and the lithologic similarity with the type area. The age of the Nyaungbaw Formation may indicate the Silurian by the presence of microfossil content, lithological character and relative stratigraphic position. The Zebingyi Formation may indicate the Early-Middle Devonian age by the occurrences of the diverse fauna assemblages including Trilobites, Cephalopods and Pteropods fossils (*Tentaculites elegans* and *styliolina* sp.). The Plateau Limestone Group may be regarded as the Permian age by the occurrences of coral and relative stratigraphic position.

**Key words:** Stratigraphy, Sitha Formation, Kunlein Formation, Nyaungbaw Formation, Zebingyi Formation, Plateau Limestone Group

### Introduction

The study area is situated in the western part of Eastern Highland. The geology and stratigraphy of the Palaeozoic units exposed in the northern Shan State have been published by many authors La Touche (1913), (Brown & Sondhi, 1933b; Brunnschweiler, 1970; Gramann et al., 1972; Garson et al., 1976; Wolfart et al. (1984), Thura Oo et al. (2002), Aye Ko Aung, 2012; Aye Ko Aung & Cocks, 2017 and Zaw Win et al. 2004). It has been revised and reassigned the age of some unit by Aye Ko Aung & Cocks (2017). The stratigraphy of Late Palaeozoic and Mesozoic units of northern Shan State was developed by La Touche (1913). The most areas of northern Shan State had been studied well. The study area is located in Pyin Oo Lwin Township, Mandalay Region (Fig. 1). Thus the purpose of this study is to describe the stratigraphy of the rock units exposed in that area

### Stratigraphy

The study area is mainly composed of the Paleozoic carbonate rocks and minor amount of clastic rocks. There are five lithostratigraphic units exposed in the study area. They are the Sitha Formation, the Kunlein Formation, the Linwe Formation, the Zebingyi Formation and the Plateau Limestone Group.

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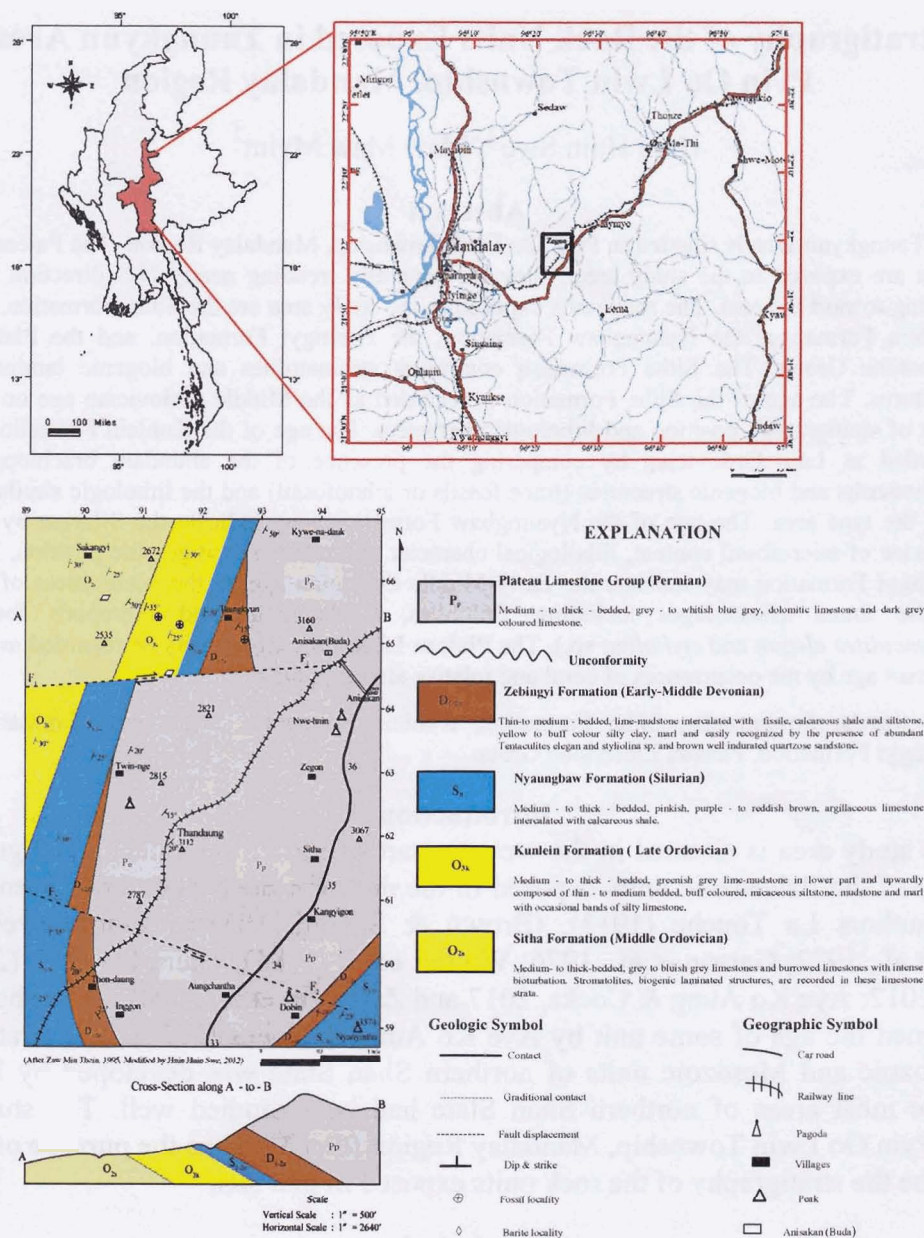


Fig. 1 The location and geological maps of Taungkyun area.

**Sitha Formation**

The Sitha Formation was named by Mandalay University Geology Field Party (1983) after the Sitha village. It is widely distributed in the northwestern corner of the study area. It is well exposed about 2 miles west of Taungkyun village. Good exposures are also found near the Sakangyi village.

This formation is composed mainly of medium- to thick-bedded, grey- to bluish grey, and yellowish limestone with intense bioturbation. Thinly laminated, bluish grey coloured limestones with secondary calcite vein occur in some places (Fig. 2a). The gradational contact between Sitha Formation and overlying the Kunlein Formation can be seen in the west of Taungkyun village. The lower boundary of this unit has not been recognized in the study area.

The biogenic structures are very common in the upper part of Sitha Formation. Stromatolites, biogenic laminated structures, are recorded in these limestone strata. Describing stromatolites in the field is domal microbial structure (Fig. 2b). Some of stromatolitic structures are associated with the barite deposit. The Sitha Formation is

regarded as age of Middle Ordovician age on the basis of relative stratigraphic position and lithologic characters with the type section area. The Sitha Formation can be correlated with the Wunbye Formation of southern Shan State.

### **Kunlein Formation**

The Kunlein Formation was first named by Aye Ko Aung (2012) after the Kunlein village. This unit is widely distributed in the northwestern part of the study area. It is well exposed nearly 1 mile west of Taungkyun village. The lower part of this unit is mainly composed of medium- to thick-bedded, greenish grey lime-mudstone (Fig. 2c). The sequence is upwardly composed of thin - to medium bedded, buff coloured, micaceous siltstone, mudstone and marl with occasional bands of silty limestone which are highly jointed and brecciated.

The siltstone of Kunlein Formation is recognized by the presence of fragments of *Aulechinus* sp., *Rhynchonella* sp., *Strophodonta* sp. and biogenic structures (Fig. 2d-f). Biogenic structures include especially trace fossils or ichnofossils which are the fossilized tracks, excavations, and domiciles of animals. The nature of contact of Kunlein Formation with the overlying the Nyaungbaw Formation and underlying Sitha Formation are gradational in the study area. According to the lithology, fauna content and its stratigraphic position, the age of this unit is most probably Late Ordovician. The Kunlein Formation of the present study area can be comparable with the Nan-on Formation of the Pindaya Group in southern Shan State (Maung Thein, 2014).

### **Nyaungbaw Formation**

The Nyaungbaw Formation was introduced by the Burmese National Committee, I.G.C.P (1980) after Nyaungbaw village. The Nyaungbaw Formation is widely distributed in the study area. Good exposures are cropped out east of Dobin and west of Nyanyintha hill. It is fairly exposed at the west of Taungkyun, Twinngge village and western side of Thondaung rail-way station.

The phacoidal or nodular structure is the characteristic of Nyaungbaw Formation. The Nyaungbaw Formation is mainly composed of medium - to thick - bedded, pinkish, purple - to reddish brown, argillaceous limestone intercalated with calcareous shale (Fig. 3a). Geopetal structures commonly form beneath shells and within skeletal grains that formed in argillaceous limestone of Nyaungbaw Formation in the study area (Fig. 3b).

This unit conformably overlies the Kunlein Formation and it is overlain by the Zebingyi Formation. In the study area, mega fossils were not found in this unit. There was a long controversy about the age of Nyaungbaw Formation or equivalent stratigraphic units. According to finding of Early Silurian graptolites in the Nyaungbaw Formation by many geologists, its age and stratigraphic position can be assigned as Silurian. Based on the microfossil content, lithological character and relative stratigraphic position, the Nyaungbaw Formation can be correlated with Linwe Formation of southern Shan State.



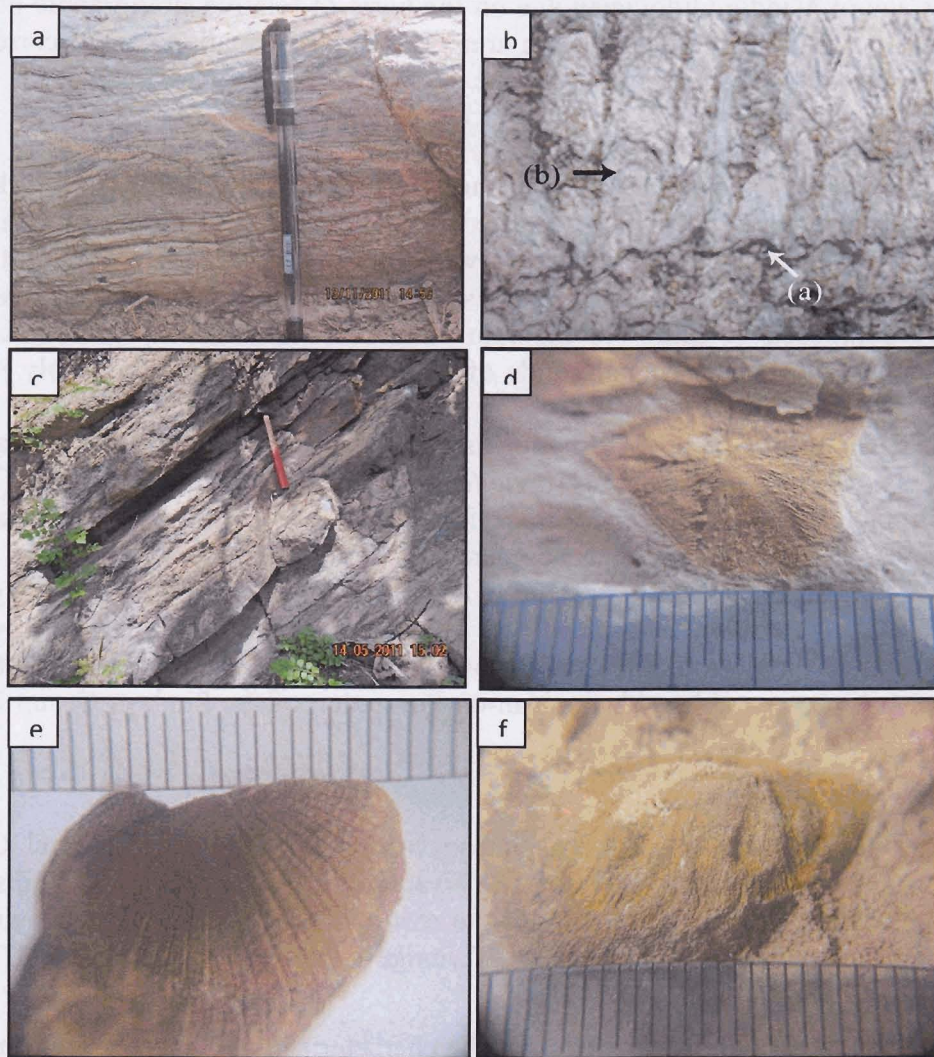


Fig. 2 The field photographs of the Sitha Formation (a & b) and the Kunlein Formation (c-f). (a) thinly laminated, bluish grey coloured limestone intercalated with silt partings in the Sitha Formation, (b) the stylolite seam formed due to the pressure dissolution (a) and domal stromatolites (b) formed in the laminated stromatolitic limestone of the upper part of the Sitha Formation, (c) thin bedded, light grey - to grey crystalline limestone in the Kunlein Formation, (d) *Aulechinus* sp. (e) *Rhynchonella* sp., (f) *Strophodonta* sp.

### Zebingyi Formation

The name of Zebingyi Formation was given by La Touche (1913), after Zebingyi village. This unit is thinly distributed in all part of the study area. It is fairly exposed in the vicinity of Taungkyun, Twinngge, Kangyigon, Dobin, Ingon villages and Thondaung railway station.

The Zebingyi formation can be subdivided into three members, due to the lithologic character. The lower member consists of thin- to medium-bedded, lime-mudstone intercalated with fissile, calcareous shale and siltstone. This member is yellow to buff colour silty clay, marl and easily recognized by the presence of abundant *Tentaculites elegans* and *styliolina* sp. (Fig. 3c). The middle member, dominantly composed of thin- to medium-bedded, whitish to light grey, flaggy, partially dolomitized limestone intercalated with thinly bedded silt partings. Fossils are rare in this member. The upper member is mainly composed of thin- to medium-bedded, fine- to medium-grained, pinkish to reddish brown well indurated quartzose sandstone (Fig. 3d). The contact between the Zebingyi Formation and the underlying



Nyaungbaw Formation seems to be gradational and unconformably overlain by the Plateau Limestone Group.

The *Michellinoceras* sp. (Fig. 3e) and *Phacops taungtalonensis* sp. (Fig. 3f) fossils are collected from the Zebingyi Formation. According to the fauna assemblages and its stratigraphic position, the Zebingyi Formation of the present area can be suggested as Early-Middle Devonian age. On the basis of above mentioned facts the sub-phacoidal limemudstone and shale-siltstone member of the Zebingyi Formation can be correlated with the upper part of the Wabya Formation in southern Shan State (Myint Lwin Thein, 1973).

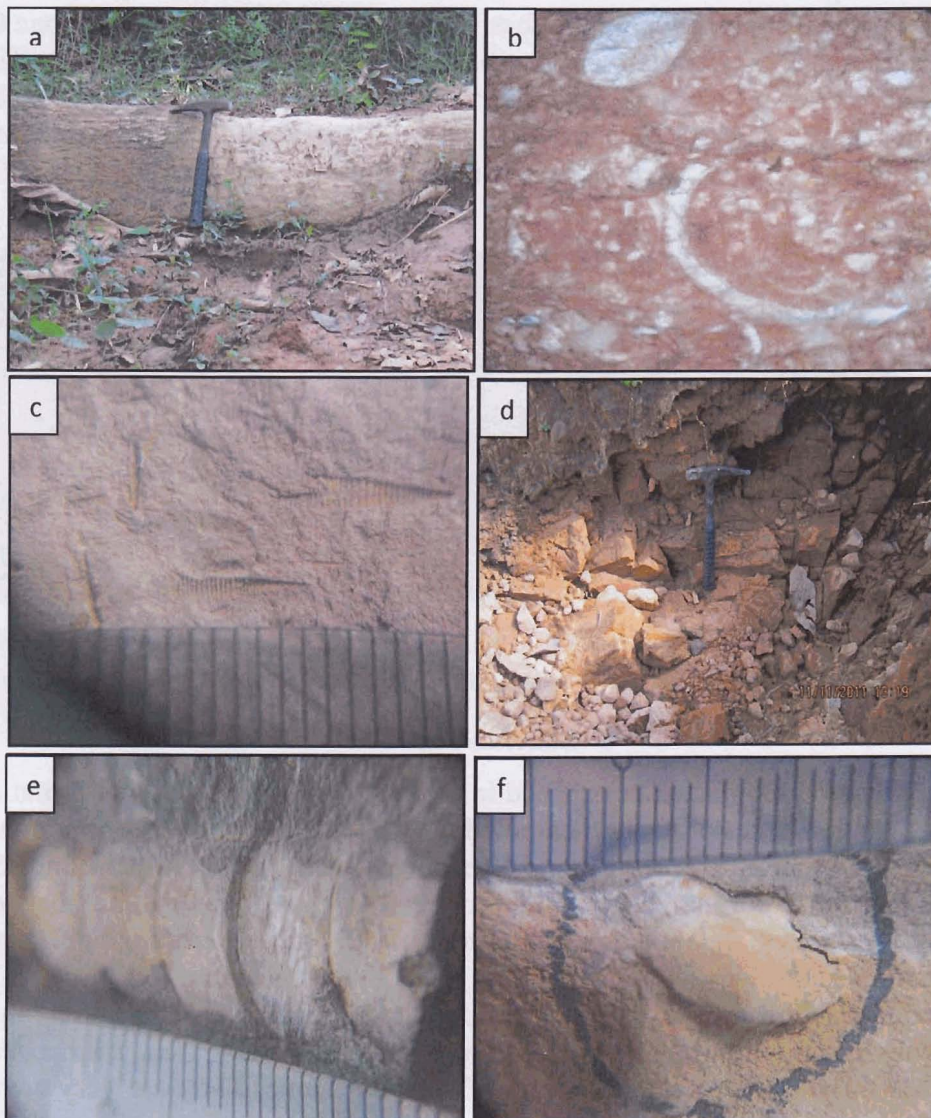


Fig. 3 The photographs of the Nyaungbaw Formation (a & b) and the Zebingyi Formation (c-f). (a) medium- to thick-bedded, purple to reddish brown coloured, phacoidal structure in limestone of the Nyaungbaw Formation, (b) the geopetal structure with gastropods in the argillaceous limestone of the Nyaungbaw Formation, (c) *Tentaculites elegans* and *Styliolina* sp., (d) thin bedded, reddish brown coloured orthoquartzite of upper member in the Zebingyi Formation, (e) *Michellinoceras* sp., (f) *Phacops taungtalonensis* sp.

### Plateau Limestone Group

The name Plateau Limestone Group was first proposed by La Touch (1913) and because of a constant usage till at present. This unit is widely exposed on the Shan Plateau. The rock of Plateau Limestone Group was informally divided into Lower Plateau Limestone and Upper Plateau Limestone. The Lower Plateau Limestone is widely distributed in the

study area. The best exposures are cropped out at the vicinity of Twinnge and Kywenadauk villages.

It is predominantly consists of medium- to thick-bedded, grey to whitish blue grey, dolomitic limestone (Fig. 4a). The Upper Plateau Limestone is widely distributed in the study area. Good exposures are exposed at Thandaung, vicinity of Waboye and Ingon villages, and along the Sitha Chaung. This unit is mainly composed of thick-bedded to massive, bluish grey to dark grey coloured limestone with calcite cross veinlets. Some occurrence of hematite frequently through the unit (Fig. 4b), especially at the locality of isolated hill lock, locally called "Thandaung".

In the present study, although no fossil found in the the Plateau Limestone Group, it is regarded as the age of Permian on the basis of fauna content by Thaw Tint (1972), stratigraphic position and lithologic characters. On the basis of the stratigraphic position, the Plateau Limestone Group can be correlated with the Thitsipin Formation in southern Shan State (Garson et al., 1976) and the Tonbo Limestone in the northern Shan State (Brunnschweiler, 1970).

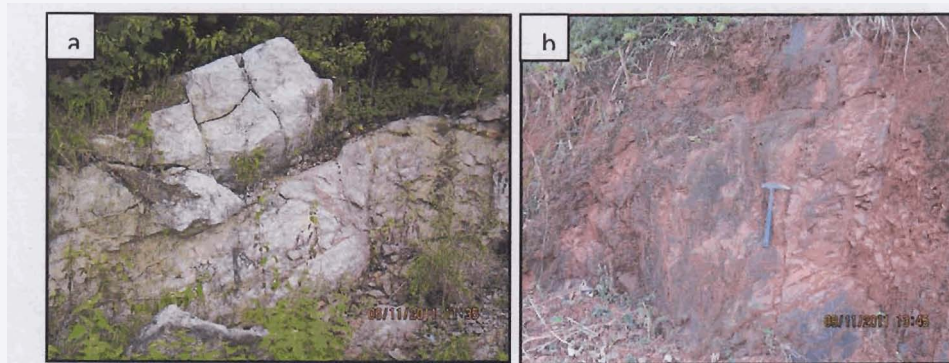


Fig. 4 The field photographs (a& b) (a) medium- to thick-bedded, grey to whitish blue grey coloured limestone, (b) the iron ore is associated with reddish brown coloured limestone,

### Conclusions

The lithostratigraphic units exposed in the study area are the Sitha Formation (Middle Ordovician), the Kunlein Formation (Late Ordovician), the Nyaungbaw Formation (Silurian), the Zebingyi Formation (Early-Middle Devonian) and the Plateau Limestone Group (Permian). The Sitha Formation is mainly composed of medium- to thick-bedded, grey to bluish grey limestones and burrowed limestones with intense bioturbation. Stromatolites, biogenic laminated structures, are recorded in these limestone strata. The Kunlein Formation is mainly composed of medium- to thick-bedded, greenish grey lime-mudstone in lower part and upwardly composed of thin- to medium-bedded, buff coloured, micaceous siltstone, mudstone and marl with occasional bands of silty limestone. They are very common with brachiopods, echinoderms and biogenic structures. The Nyaungbaw Formation is mainly composed of medium- to thick-bedded, pinkish, purple to reddish brown, argillaceous limestone intercalated with calcareous shale. Geopetal structures commonly form beneath shells and within skeletal grains that formed in argillaceous limestone. The Zebingyi formation is mainly composed of thin- to medium-bedded, lime mudstone intercalated with calcareous shale and siltstone, yellow to buff colour silty clay, marl and easily recognized by the presence of abundant *Tentaculites elegans* and *styliolina* sp. and brown well indurated quartzose sandstone. The Trilobites, Cephalopods and Pteropods fossils are collected from Zebingyi Formation. The Plateau Limestone Group is mainly composed of medium- to thick-bedded, grey to whitish blue grey, dolomitic limestone in the lower part and thick-bedded to massive, bluish grey to dark grey coloured limestone with calcite cross veinlets in the upper part.



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36. **Morphology and Anatomy of *Pinus kesiya* Royle ex Gordon Grown in Southern Shan State, Myanmar** 279  
Phyo Aung
37. **Sequence Stratigraphic Interpretation of the Permian Carbonates in Loikaw Area, Kayah State** 287  
Kyi Pyar Aung
38. **Stratigraphy of the Miocene Rock Units Exposed in Hmendaung Area, Eastern Part of Chindwin Basin** 299  
Moe Thu Sint, Maung Maung
39. **Antimony Mineralization of Loiharmyar Area, Hopong Township, Southern Shan State** 307  
Nang Sandi Lwin, Lae Lae Win, Ei Shwe Sin
40. **Environmental Impact of Lead Mine in Bawsaing Area, Kalaw Township, Shan State (south)** 315  
Lae Lae Win , Nang Sandi Lwin
41. **Microfacies Analysis of some Carbonate rocks in Yan-aung range area, Taunggyi Township, Shan State (South), Myanmar** 321  
Nang Kham Sein, Sandar Win
42. **Landslide susceptibility mapping in Taunggyi area by using model builder tool and weighted overlay tool in GIS** 333  
Thein Than Htike
43. **Stratigraphy of the Rock Units Exposed in Taungkyun Area, Pyin Oo Lwin Township, Mandalay Region** 345  
Hnin Hnin Swe, Maw Maw Myint

