

LITHOFACIES ANALYSIS OF PALEOCENE AND EARLY EOCENE UNITS OF SABADAN AREA, MINDON TOWNSHIP, MAGWAY REGION

Win Lwin Thein¹, Paing Soe², Aye Ko³

Abstract

The study area, Sabadan area is located in the Mindon Township, Magway Region. It lies between latitude 19°07'00" to 19°11'10" and longitude 94°47' 20" to 94° 51' 40". The study area is situated between the Central Cenozoic Belt and Western Ranges. The eastern part of the area (to the east of the Kabaw Fault) occupies Paleocene to Eocene molasses type units of Paunggyi Formation, Laungshe Formation, Tilin Formation and Tabyin Formation. Among these, only two lithofacies are detail studied. Four lithofacies association can be established in the late Paleocene and early Eocene of Paunggyi and Laungshe Formations. They are (1) submarine fan Association, (2) Offshore Association (3) Shoreface Association (4) Delta front Association. The Paunggyi Formation shows at submarine fan environment, which include upper fan, middle fan and lower fan. The environment of Laungshe Formation is classified into three major group; offshore, shore face and delta front. There are four lithostratigraphic units are exposed in the Sabadan area, but only two lithostratigraphic units of the Paunggyi Formation and Laungshe Formation are detailed study.

Keywords: molasses, facies, lithostratigraphic unit

Introduction

The study area, Sabadan area, is situated between the Central Cenozoic Belt and Western Ranges bounded in the northeast by Minbu basin, in the west by Western Ranges, in the southeast by Pyay embayment. The Sabadan area occupies Paleocene to Eocene molasses type units and had been conducted by many workers as petrology, petrogenesis and other general geology. However, the detailed sedimentology studies including lithofacies analysis and their distinct depositional environments have still needed in the study area and the present study attempt to decipher the lithological characteristics and depositional environments mainly on Paunggyi and Laungshe (Paleogene) units.

Materials and Methods

After the field investigation, the observed data were plotted on the base map and geological map was drawn by using field data and lithologic evidences. And then, the paper was prepared step by step. The data collected in the field were firstly evaluated. On the basis of the recent field data and other literatures, the proper outlines were selected for the preparation of final dissertation. The measured data were applied for the establishment of stratigraphic succession and detailed logs. The lithofacies were classified according to the facies codes modified from (Miall, 1978-b in Walker, 1922) on the basis of grain size, primary sedimentary structures and lithologic signatures.

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1. Lithofacies Analysis of Paunggyi and Laungshe Formations

3.1. Lithofacies Characteristics

3.1.1 Facies A: matrix supported conglomerate (Cmc)

Description

This Facies occurs in the both Paunggyi Formation and Laungshe Formation (Fig. 3.a and b). In the Paunggyi Formation, matrix supported conglomerate are mostly occurs at the base. It is mainly composed quartz pebbles, sandstone fragment, clay pebbles and metamorphic rock fragment. The nature of the boundaries between contact unit are sharp. In the Middle part, thick bedded to massive conglomerate are occurred and small amount of conglomerate beds are also occurred at the upper part of the Paunggyi Formation. The Facies is associated with gritty sandstone of Facies C, sand-shale interbed sequence of Facies I and massive shale of Facies J.

In Laungshe Formation, matrix supported conglomerate facies (Gcm) is observed as the lower part. It is composed of quartz pebbles, sand clasts and sandstone fragments. The size of quartz pebbles and sand clasts range from 1mm to 2 cm in diameter and most of the quartz pebbles and sandstone clasts are subangular to subrounded and lacking graded nature.

3.1.2 Facies B: Sandstone with mud clasts (Smc)

Description

This Facies occurs in the lower and middle part of the Paunggyi Formation (Fig. 3.c). In the Lower part, thin to medium bedded, dark grey to grey colored, coarse grained sandstone are occurred.

This sandstone contains mud clasts which the size is 0.5 to 1 cm. Medium grained sandstone also occurred middle part of the Paunggyi Formation which they contain little amount of mud clast. The nature of the contact unit is gradational. This Facies is distributed in the lower part and middle part of the Laungshe Formation (Fig.3.d). It is mainly composed of light grey to grey colored, medium grained sandstone with mud clasts. The thickness of mud clast is 1cm to 3cm. Sandstone with mud clasts did not observed upper part of Laungshe Formation. The nature of the boundaries with underlying unit is gradational and upper unit is sharp.

This Facies is associated with matrix supported conglomerate of Facies A, gritty sandstone of Facies C and sandstone with asymmetrical wave ripple of Facies D.

3.1.3 Facies C: Gritty sandstone (Sg)

Description

The facies have thin to medium bedded, greenish grey to dark grey colored gritty sandstone occur at the upper part of the Paunggyi Formation (Fig. 3.e). Gritty sandstone contained mud clast. The contact between lower unit and upper unit are sharp. This Facies is associated bioturbated sandstone of Facies D and massive shale of Facies J.

This Facies is distributed in the lower part of the Laungshe Formation. It is composed of medium bedded, light grey to grey colored, gritty sandstone. Gritty sandstone is not observed at the middle and upper part of the Laungshe Formation. The contact between the lower unit and upper unit are gradational. This Facies is associated with matrix supported conglomerate of Facies A, sandstone with mud clasts of Facies B and sandstone with asymmetrical wave ripple of Facies D.

3.1.4 Facies D: bioturbated sandstone (Sb)

Description

This Facies is exposed at the both Paunggyi and Laungshe Formation(Fig. 3.f and 4.a). Bioturbated sandstone occur in the lower part of the Paunggyi Formation which is characterised by thin to medium bedded, grey colored, fine grained bioturbated sandstone. The nature of the boundaries contact with the lower unit is sharp and upper unit is gradational. This Facies is associated with gritty sandstone of Facies B and massive shale of Facies J.

Bioturbated sandstone is occur in the lower, middle and upper part of the Laungshe Formation composed of thin to medium bedded, greenish grey to grey colored sandstone with bioturbation. The contact between lower and upper units are sharp. This Facies is associated with sandstone with load cast of Facies E, sandstone with wavy bedding of Facies H and sand-shale interbed sequence of Facies I.

3.1.5 Facies E: Sandstone with Load Cast (Sl)

Description

This facies is distributed in the upper part of the Laungshe Formation (Fig. 4.b). This facies is mainly composed of light grey to grey colored, thin to medium- bedded sandstone with load casts.The upper boundary and lower boundary are gradational. This Facies is associated with bioturbated sandstone of Facies D, sandstone with wavy bedding of Facies H and sand-shale interbed sequence of Facies I.

3.1.6 Facies F: Sandstone with asymmetrical wave ripple (Sr)

Description

This Facies is distributed in the lower member of the Laungshe Formation (Fig. 4.c). It is mainly composed of dark grey to grey colored, fine to medium bedded, fine grained sandstone with asymmetrical ripple mark. The lower boundary and upper boundary are sharp. This Facies is associated with matrix supported conglomerate of Facies A, sandstone with mud clast of Facies B and gritty sandstone of Facies C.

3.1.7 Facies G: Horizontal laminated sandstone (Sh)

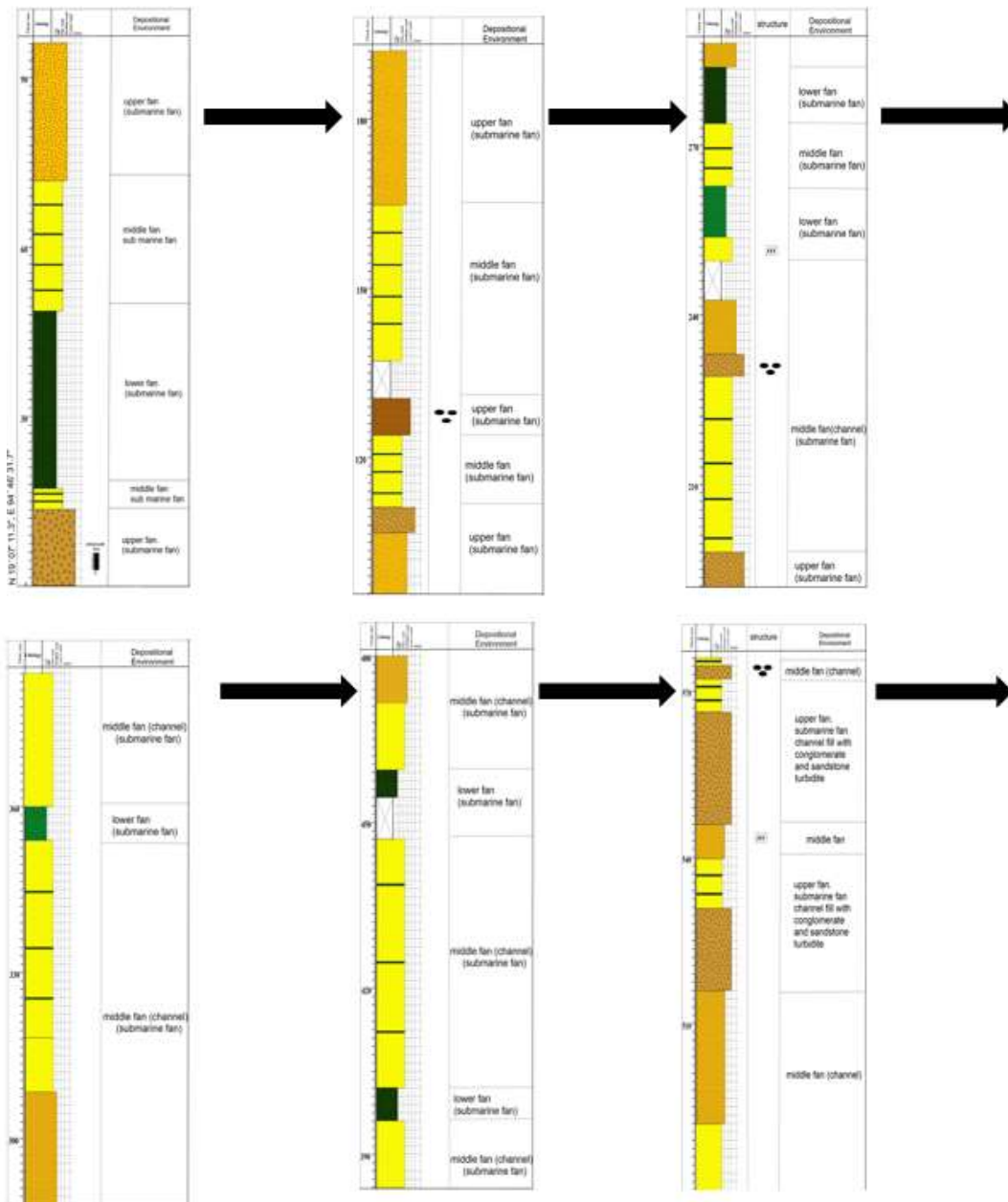
Description

This Facies is distributed in the upper part of the Laungshe Formation (Fig.4. d). It is composed of grey colored, fine grained horizontal laminated sandstone. The nature of boundary between upper and lower boundary is gradational. This Facies is associated with asymmetrical wave ripple of Facies F and sandstone with wavy bedding of Facies I.

3.1.8 Facies H: Sandstone with wavy bedding (Sw)

Description

This Facies is mostly distributed in the upper part of the Laungshe Formation (Fig. 4.e).It is composed of thin bedded, grey colored, fine grained sandstone with wavy bedding. The contact between lower unit and upper unit is gradational. This Facies is associated with bioturbated sandstone of Facies D, sandstone with load cast of Facies E and sand-shale interbed sequence of Facies I.



Vertical Scale

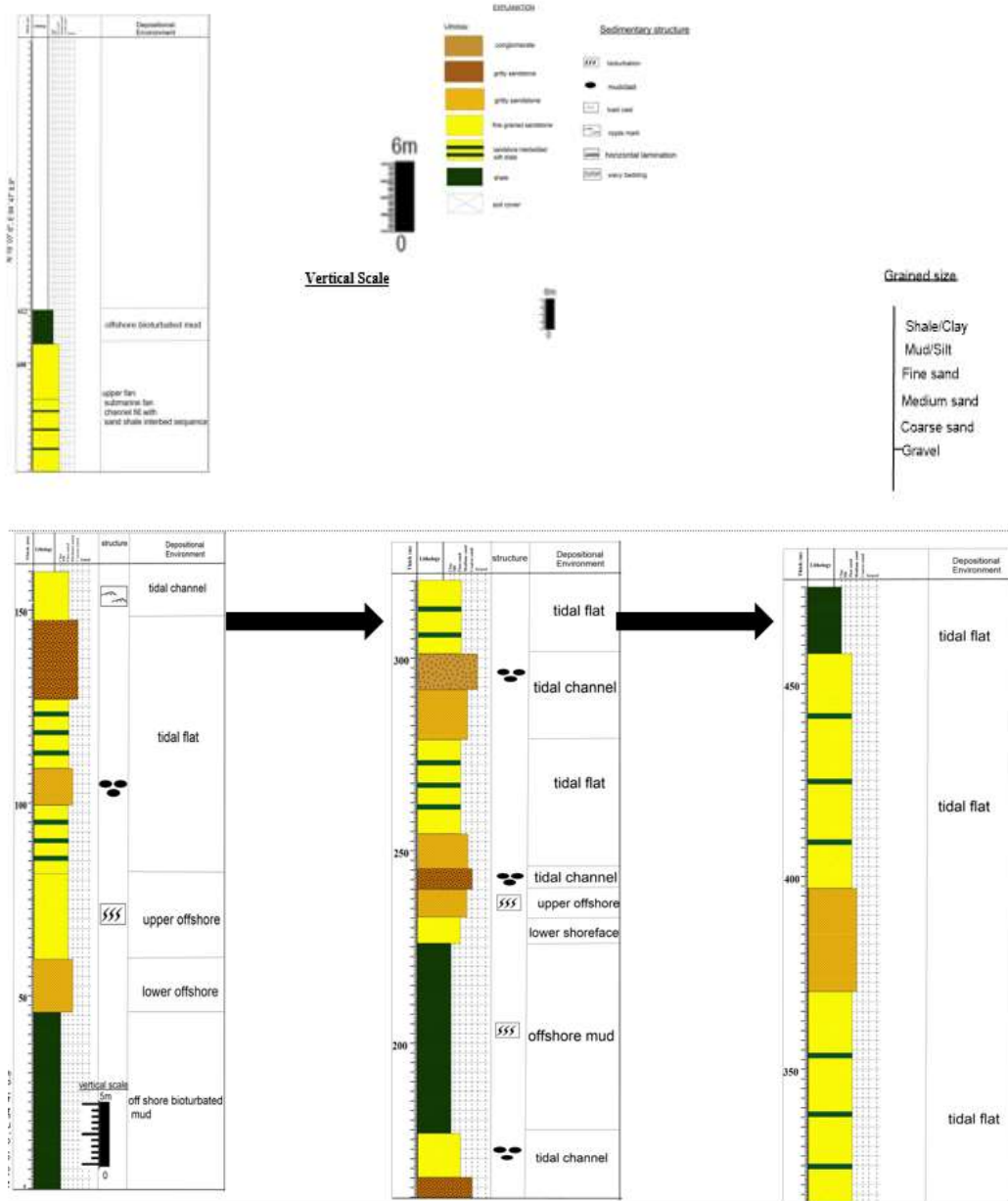


Figure 2 Detailed facies column of the Paunggyi and Laungshe Formations measured along the Shu Chaung sections in the Sabadan Area.

3.1.9 Facies I: Sand-shale interbed sequence (Fsh)

Description

This facies is widely distributed in the Paunggyi Formation and Laungshe Formation (Fig.4.f and 5.a). It is mainly composed of fine- grained, light grey colored sandstone and grey colored shale. This Facies is associated with bioturbated sandstone of Facies D, sandstone with load clast of Facies E and horizontal laminated sandstone of Facies G. The contact between the lower unit and upper unit are gradational.

3.1.10 Facies J: massive shale (Fm)

Description

The Facies are occurred at the both of Paunggyi and Laungshe Formation (Fig. 5. b). In the Paunggyi Formation, dark grey to black colored, thick bedded to massive shale are occurred and massive shale are also occurred at the Laungshe Formation. This Facies is associated with gritty sandstone of Facies C and bioturbated sandstone of Facies D. The contact of these two Facies is sharp contact.

3.2 Lithofacies Association

The combination of two or more facies, which were formed in a single depositional environment at the same time, is grouped into a facies association. A facies association can thus be used for more detailed interpretation of depositional environments. Lithofacies have been classified on the basis of sedimentary structures, lithology and fossils. Lithofacies associations were distinguished with respect to their lithology, facies successions and bed geometry. They are

1. Submarine fan lithofacies association
2. Offshore lithofacies association
3. Shore face lithofacies association and
4. Delta front lithofacies association

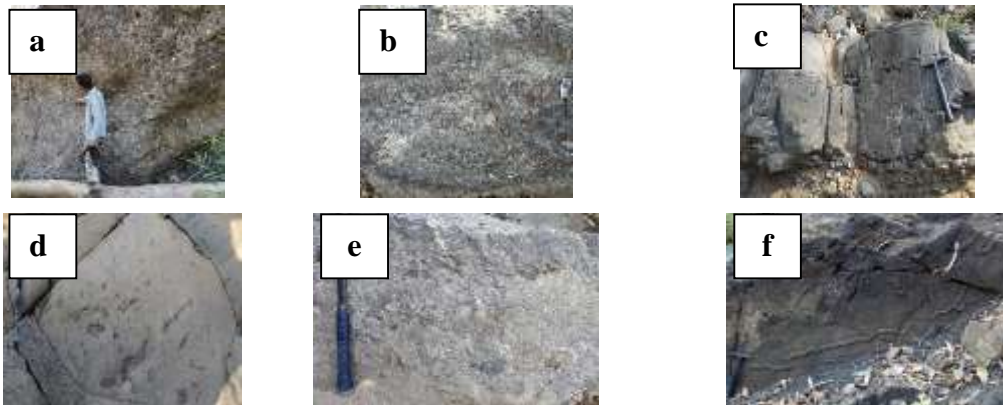


Figure 3 (a) Matrix supported conglomerate of Paunggyi Formation exposed at the Sabadan area (b) matrix supported conglomerate of Laungshe Formation exposed at the Sabadan area (c) thin to medium bedded, dark grey to grey colored, coarse grained sandstone with mud clast in Paunggyi Formation exposed at the Sabadan area (d) light grey to grey colored, medium grained sandstone with mud clasts in Laungshe Formation exposed at the Sabadan area (e) Greenish grey to dark grey colored gritty sandstone exposed at the Sabadan area (f) medium bedded, grey colored, fine grained bioturbated sandstone of Paunggyi Formation exposed at the Sabadan area.

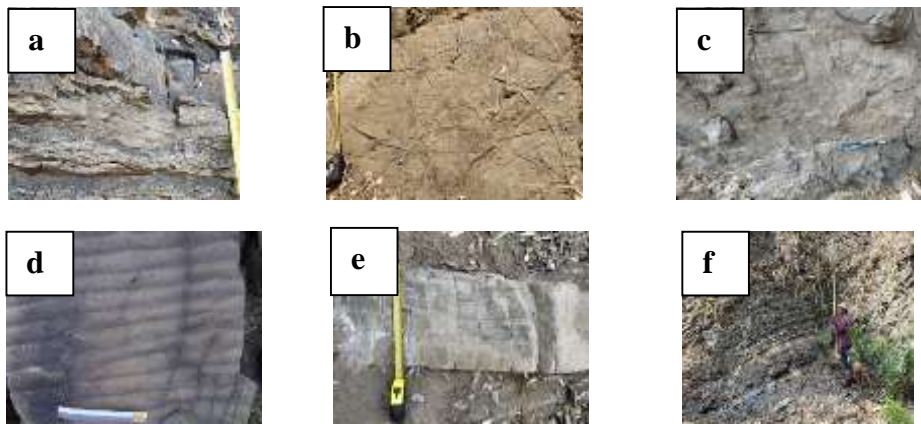


Figure 4 (a) thin to medium bedded, greenish grey to grey colored sandstone with bioturbation of Laungshe Formation exposed at the Sabadan area (b) Light grey to grey colored, thin to medium-bedded sandstone with load casts of Laungshe Formation exposed at the Sabadan area (c) Dark grey to grey colored, fine to medium bedded, fine grained sandstone with asymmetrical ripple marks exposed at the Sabadan area (d) Grey colored, fine grained horizontal laminated sandstone of Laungshe Formation exposed at the Sabadan area (e) Thin bedded, grey colored, fine grained sandstone with wavy bedding of Laungshe Formation exposed at the Sabadan area (f) Sand-shale interbed sequence of Paunggyi Formation exposed at the Sabadan area.



Figure 5 (a) Sand-shale interbed sequence of Laungshe Formation exposed at the Sabadan area (b) Dark grey to black colored, thick bedded to massive shale exposed at the Sabadan area.

3.3 Depositional environment of Paunggyi and Laungshe Formation

The Paunggyi Formation shows a submarine fan environment which includes upper fan, middle fan and lower fan. In the channel of the upper fan is the area of deposition of conglomerate, in my study area, matrix supported conglomerate may be deposited as upper fan. Middle fan of submarine fan also shows a sequence that may be deposited as middle fan, and lower fan includes massive shale. So, the depositional environment of Paunggyi Formation may be deposited as a submarine fan environment (Fig. 6).

The environment of Laungshe Formation is classified into three major groups: offshore, shore face and delta front. Offshore includes offshore bioturbated mud, lower offshore and upper offshore. Upper offshore, muddy fine sand shows laminated sand and bioturbated sand. In the study area, gritty sandstone and bioturbated sandstone may be deposited in an offshore environment. Shoreface includes tidal channels and tidal flats. Tidal channels contribute an important part to the development of tidal flats. Subtidal zones are made up of channels and sand bar sediments. Bioturbation is very weak, as the rate of sedimentation is very high in the tidal channel. The tidal channel may show sandstone with asymmetrical wave ripple. The channel bottoms of the larger tidal channels are mostly sandy, matrix supported conglomerate, sandstone with mud clast and gritty sandstone may serve as channel deposits.

Tidal flat develop along the gently dipping seacoasts with marked tidal rhythms, where enough sediment is available and strong wave action is not present. The tidal flat is located marginal parts of intertidal zone. Intertidal zone are located between the high and low water lines over a vertical range of usually 2 or 3 m, and up to 10 or 15 m, depending upon the tidal range. The primary sedimentary structures including mega-ripple, small scale cross bedding on the sand flat, wavy and lenticular bedding which were formed under tidal flat condition. Muddy tidal flat deposits rich in organic material may contain sandy sediments. Massive shale, horizontal laminated sandstone and sand-shale interbed sequence are character of delta front. Therefore, the depositional environment of Laungshe Formation can be defined as shoreface and delta front environment.

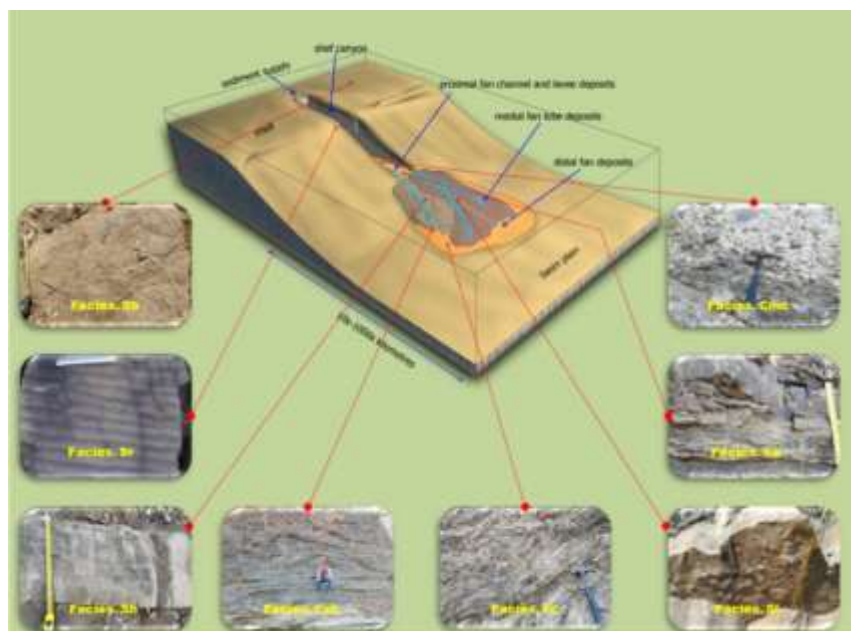


Figure 6 Depositional Environments model on a shelf, shelf canyon (channel) and submarine fan of the Sabadan area, Mindon Township

Conclusion

The study area, Sabadan area, is situated between the Central Cenozoic Belt and Western Ranges. It is bounded in the northeast by Minbu basin, in the west by Western Ranges, in the southeast by Pyay embayment. The eastern part of the area (to the east of the Kabaw Fault) occupies Paleocene to Eocene molasses type units of Paunggyi Formation, Laungshe Formation, Tilin Formation and Tabyin Formation. Among them, only two lithofacies representing the Paleocene and early Eocene units are studied in detail. Four lithofacies association, which were distinguished with respect to their lithology, facies successions and bed geometry can be established in the late Paleocene and early Eocene of Paunggyi and Laungshe Formations. They are (1) Submarine fan lithofacies association, (2) Offshore lithofacies association, (3) Shore face lithofacies association and (4) Delta front lithofacies association.

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Acknowledgement

I would like to express gratitude to Dr. Paing Soe, Associate Professor and U Aye Ko, Lecturer, Department of Geology, University of Magway. Thanks are also due to people who helped during the field trip in Sabadan area, and colleagues of Department of Geology, University of Magway for their comments.

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