

Facies Analysis of Kyaukkok Formation in the Yenangyaung Area, Magway Region

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Abstract

Yenangyaung area is situated in Magway Region. It lies between North Latitude 20° 25' to 20° 33' and East Longitude 94° 50' to 94° 58' and falls in one-inch topographic maps of 84 L/14 and 84 L/15. There are two lithostratigraphic units exposed in the study area namely Kyaukkok Formation and Irrawaddy Formation. The contact between these two Formations is unconformable and marked by a distinct ferruginous layer called "Red Bed". The present study mainly emphasizes on the facies analysis of Kyaukkok Formation to interpret the depositional environment. The classified ten lithofacies and three facies associations of Kyaukkok Formation indicate the wave influenced delta front, tidal influenced lower delta plain associated with shoreface, and fluvial dominated upper delta plain environments.

Keywords: *Facies Analysis, Yenangyaung Area, Kyaukkok Formation*

Introduction

Yenangyaung area is situated in Magway Region. It lies between North Latitude 20° 25' to 20° 33' and East Longitude 94° 50' to 94° 58' and falls in one-inch topographic maps of 84 L/14 and 84 L/15. There are two lithostratigraphic units exposed in the study area namely Kyaukkok Formation and Irrawaddy Formation. There are two lithostratigraphic units exposed in the study area namely Kyaukkok Formation and Irrawaddy Formation. The location map of the study area is shown in figure (1).

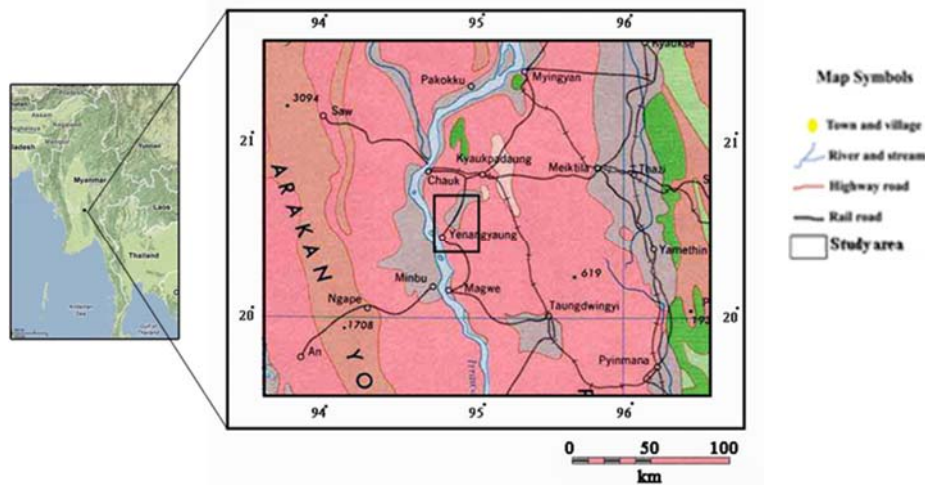


Figure (1). Location map of the Yenangyaung area

Physiography

Topographically, the study area is represented by low lying rolling terrain typified by badland topography in the central part. The northeastern part of the area is occupied by thick soil cover and cultivation is carried out in this flat lying area. Pin Chaung creates the

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main stream of the study area, running roughly E-W direction.. The area is dominantly underlain by alternating unit shows trellis drainage pattern, especially the area underlain by Kyaukkok Formation. The area occupied by Irrawaddy Formation shows dendritic drainage pattern.

Regional Geologic Setting

The study area is situated in the Central Cenozoic Belt of Myanmar (Maung Thein, 1976). This belt is relatively a low lying province between the Eastern Highlands to the east and the Western Ranges to the west. The study area is located in the central part of Minbu Basin.. Structurally, the study area is well known for its narrow folded strata. The Yenangyaung anticline, one of the major oil traps in Myanmar, is trending NNW-SSE direction. It is an asymmetrical anticline and bounded by broad, N-S trending asymmetrical synclinal depressions.

Stratigraphy

Geological map of the study area is shown in figure (2). The Kyaukkok Formation occupies in the crestal portion of the Yenangyaung anticline. It is mainly composed of thin to medium bedded, light brown to brown coloured sandstone interbedded with buff to yellowish grey coloured laminated silty clay (or) bluish grey shale, large scaled cross bedded sandstone, silty clay and ferruginous conglomerate lenses. Flaser and Lenticular structures, cone in cone structures, dish and pillar structures and hummocky cross stratification are present in this Formation.

The presence of *Conus* sp., *Tellina* sp., *Mesalia* sp., and index species of Foraminifera such as *Rotalia beccarii* *annectens* and *Rotalia beccarii* *Koeboeensis* indicates the age of Kyaukkok Formation may be Early to Middle Miocene and deposited under deltaic to shallow marine environment. Irrawaddy Formation is characterized by whitish to yellowish coloured, friable sandstones intercalated with a few clay/mud bands with silicified wood and some vertebrate remains. Large scaled planar and trough type cross bedding and various sized concretions are common. Based on the lithologic characters and faunal evidences, it can be concluded that the Irrawaddy Formation may be deposited under fluvial environment during Late Miocene to Pliocene time.

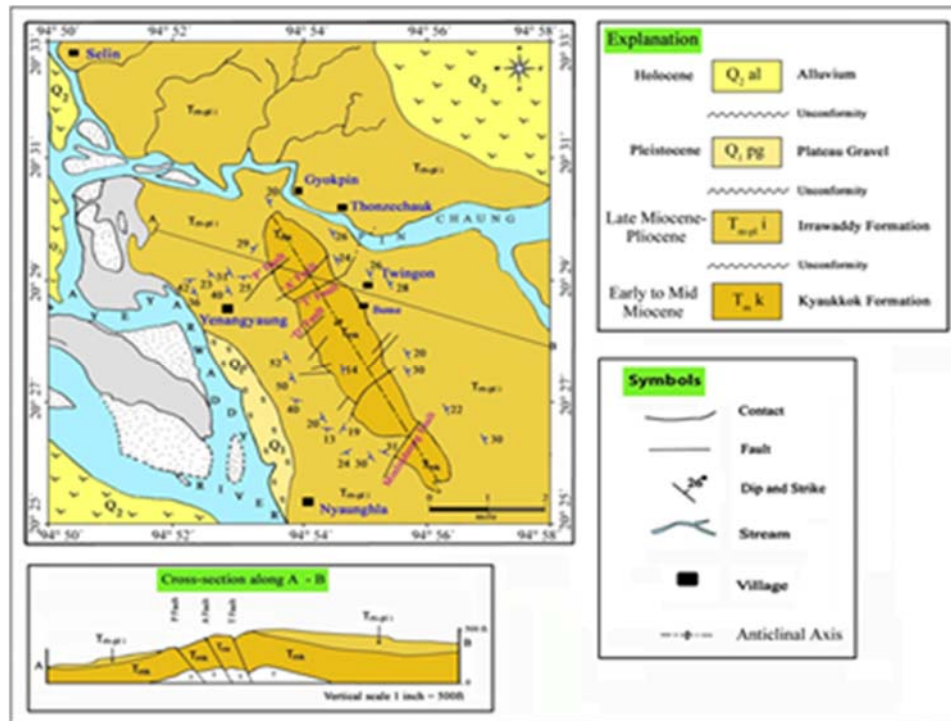


Figure (2). Geological map of the Yenangaung area, Magway region.
 (Modified after MOGE, 1965)

Sedimentary Facies Analysis

General Statement

Varieties of well preserved sedimentary features are providing for the reconstruction of the depositional processes and paleo-environmental settings. Eustatic sea level and tectonic changes are mainly control for the facies series and facies association of depositional environment (Sam Boggs, 2006). For sedimentary lithofacies analysis, the detailed vertical measured sections of these formations exposed on the flanks of Yenangaung anticline was logged and examined.

The term “Lithofacies” is defined as a body of rock with specified characteristics. It may be a single bed, or a group of multiple beds. Ideally, it should be a distinctive rock that formed under certain condions of sedimentation, reflecting a particular process, set of condition or environment (Reading, 1996). Therefore each lithofacies represents an individual depositional event.

The lithofacies were classified according to the facies codes modified from (Miall, 1978-b in Walker, 1992) on the basis of grain size, primary sedimentary structure and lithologic signature. They are described in order of decreasing grain size.

Lithofacies of Kyaukkok Formation

In the present area, Kyaukkok Formation are exposed in the crestal portion of Yenangyaung anticline. The stratigraphic measurement of Kyaukkok Formation was made along the trench section in the south of Kyaukmasin village. It can be classified as 10 lithofacies according to the particular features of lithology and the structural characteristics of Kyaukkok Formation. The facies classification and their environmental interpretation are shown in Table (1).

Table (1). Lithofacies of Kyaukkok Formation exposed at Yenangyaung Area, Magway Region.

	<u>Facies</u>	<u>Facies code(after Miall-1978-b)</u>	<u>Grain size</u>	<u>Bed Thickness (meter)</u>	<u>Structure / Texture</u>	<u>Boundary</u>	<u>Interperetation</u>
A	<u>Intraformational conglomerate</u>	<u>Gi</u>	Pebbles	1-3	crudely	sharp, erosional	channel deposit in upper delta plain
B	Thick bedded to massive sandstone sometime with concretions	<u>Sm</u>	medium to coarse-grained	2-10	jointed, concretions and nodules	sharp	foreshore associated with tidal flat
C	Laminated <u>micaceous</u> sandstone	<u>Sl</u>	medium-to-coarse grained	2-15	mica bands, disc shaped concretions	gradational	shore face
D	Planar cross bedded sandstone	<u>Sp</u>	medium-to-coarse grained	3-15	Planar cross bedding, <u>swaly</u> cross stratificationas	sharp	active distributary channel with tidal current activities
E	Ripple cross laminated sandstone	<u>Sr</u>	fine-to-coarse grained	1-2	gypsum layer climbing <u>ribbles</u> , sometimes mud veins, yellow <u>sulphur</u> band	sharp	flood plain on upper delta plain
F	Thin to medium bedded, cross bedded sandstone	<u>Sbx</u>	fine-to-medium grained	3-12	wavy lamination, hummocky cross stratification, mud <u>clasts</u> , dish and pillar structure	sharp	seaward distributary channel with tidal incursion / delta front
G	Sandstone intercalated with siltstone	<u>Sis</u>	very fine- to -medium grained	5-12	medium-to-thick bedded, <u>flaser</u> bedding, lenticular bedding	sharp	tidal sand flat in lower delta plain/ shore face
H	Sandstone <u>interbedded</u> with shale	<u>Sts</u>	very fine- to -medium grained	3-18	shell beds, cone - in - cone structure, concretions	sharp	tidal flat in lower delta plain
I	thin bedded sandstone <u>interbedded</u> with siltstone	<u>Sib</u>	very fine- to -fine grained	5-25	planar, thin bedded, highly jointed	sharp	tidal flat in lower delta plain
J	Laminated <u>silty</u> clay	<u>Cs</u>	fine grained	2-10	Laminated	sharp	delta front



Figure (3). Intraformational conglomerate of facies (A) in Kyaukkok formation



Figure (4). Thick bedded to massive sandstone of facies (B) in Kyaukkok

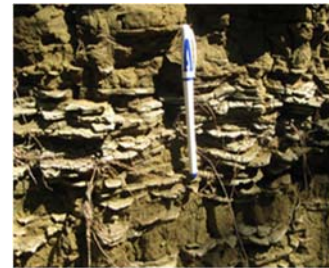


Figure (5) Laminated micaceous sandstone with disc-shaped concretions of facies (C) in Kyaukkok



Figure (6) Planar cross bedded sandstone of facies (D) in the Kyaukkok Formation



Figure (7) Ripple cross laminated sandstone of facies (E) in the Kyaukkok formation



Figure (8) Thin to medium bedded sandstone with hummocky cross stratification of facies (F) in the Kyaukkok Formation

Lithofacies Association of Kyaukkok Formation

There are three facies associations in the Kyaukkok Formation: delta front association, lower delta plain association and upper delta plain association.

Delta Front facies association

This facies association shows cross bedded, thin to medium bedded sandstone (Facies F), wavy laminated sandstone, laminated silty clay of (Facies J), medium to thick bedded sandstone intercalated with silty clay of (Facies G). Hummocky cross stratification and water escaped dish and pillar structures are observed in Facies (F). Flaser structures present in Facies (G) suggest relatively low energy mixed tidal flat. According to the lithologic characters, structural features and faunal characteristics, this facies association is attributed to the wave influence delta front association. This facies association is distinct in the lower part of Kyaukkok Formation in the study area.

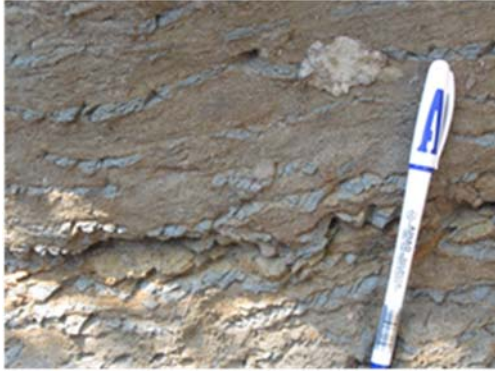


Figure (9). Flaser bedding in sandstone intercalated with siltstone unit of facies (G)



Figure (10). Sandstone interbedded with shale of facies (H) in the Kyaukkok Formation



Figure (11). Thin bedded sandstone interbedded with siltstone of facies (I) in the Kyaukkok Formation



Figure (12). Laminated silty clay of facies (J) in the Kyaukkok Formation

Lower Delta Plain facies association

The interbedded unit of sandstone and shale / clay facies (H) demonstrate the frequent alternation of tidal current and slack water condition during high tide. It indicates the environment of mixed tidal flat area. Medium to thick bedded sandstone intercalated with silty clay of facies (G) consists of climbing ripples and cross bedding. This structures may indicate the deposition in distributary channel. This facies accociation is attributed to the tidal flat environment.

Whitish quartzose sand layer alternate with parallel laminated biotite layers of facies (C) indicates the high energy flow storm wave reworking in nearshore environments. The presence of hummocky cross stratification in facies (F) suggests shoreface environment. Mud clasts in Facies (F) and shell beds in Facies (H) indicate the transgression period. The interbedded unit of Facies (H) represents the tidal current and slack water activity in tidal flat area. Thick bedded to massive sandstone with nodules and jointed character of Facies (B) represents the tidal influence foreshore environment (Reineck and Singh, 1980).

Cross bedded sandstone of Facies (D) is relating to the migration of large scale bedforms within channels and subordinate tidal currents. To the upper part Facies (H) shows trough type cross bedding filling with clay pebbles and represents as the distributary channels associated with tidal currents.

The lower delta plain facies association include sandy tidal flat, shore face and distributary channel deposits.

Upper Delta Plain Facies association

This facies association represent in the upper part of Kyaukkok Formation. It consists of intraformational conglomerate Facies (A), ripple cross laminated sandstone of Facies (E) and laminated silty clay sometimes concretionary clay of Facies (J). In their uppermost part of Kyaukkok Formation, Facies (E) contains gypsum and yellowish sulphur band and also contain silicified fossil wood fragments. The above characters show channel lag and flood plain of fluvial deposits. The presence of sulphur bands is the characteristic feature of upper delta plain deposit.

Depositional Environment of Kyaukkok Formation

The Kyaukkok Formation shows the characteristics of delta front and delta plain association. Delta plain association can be divided into upper delta plain and lower delta plain. The middle part of Kyaukkok Formation is occupied by the wave and tide dominated delta front associated facies. These include wavy laminated sandstone, laminated silty clay and hummocky cross stratified sandstone. Toward the upper, this facies association is followed by the lower delta plain association. The sandstone and shale interbedded unit with sharp contact and sometimes contain shell beds and mud drapes is the dominant facies in this portion. And then the intercalated facies with flaser and lenticular bedding and wavy lamination strongly indicate the tide and wave influence lower delta plain environment.

The upper part of Kyaukkok Formation is occupied by the fluvial influence facies such as silty clay facies, channel lag facies and ripple laminated facies.

The sulphur rich sandstone bands and some gypsum layers are observed in the uppermost part. These factors are representing to the upper delta plain environment for the uppermost part of Kyaukkok Formation.

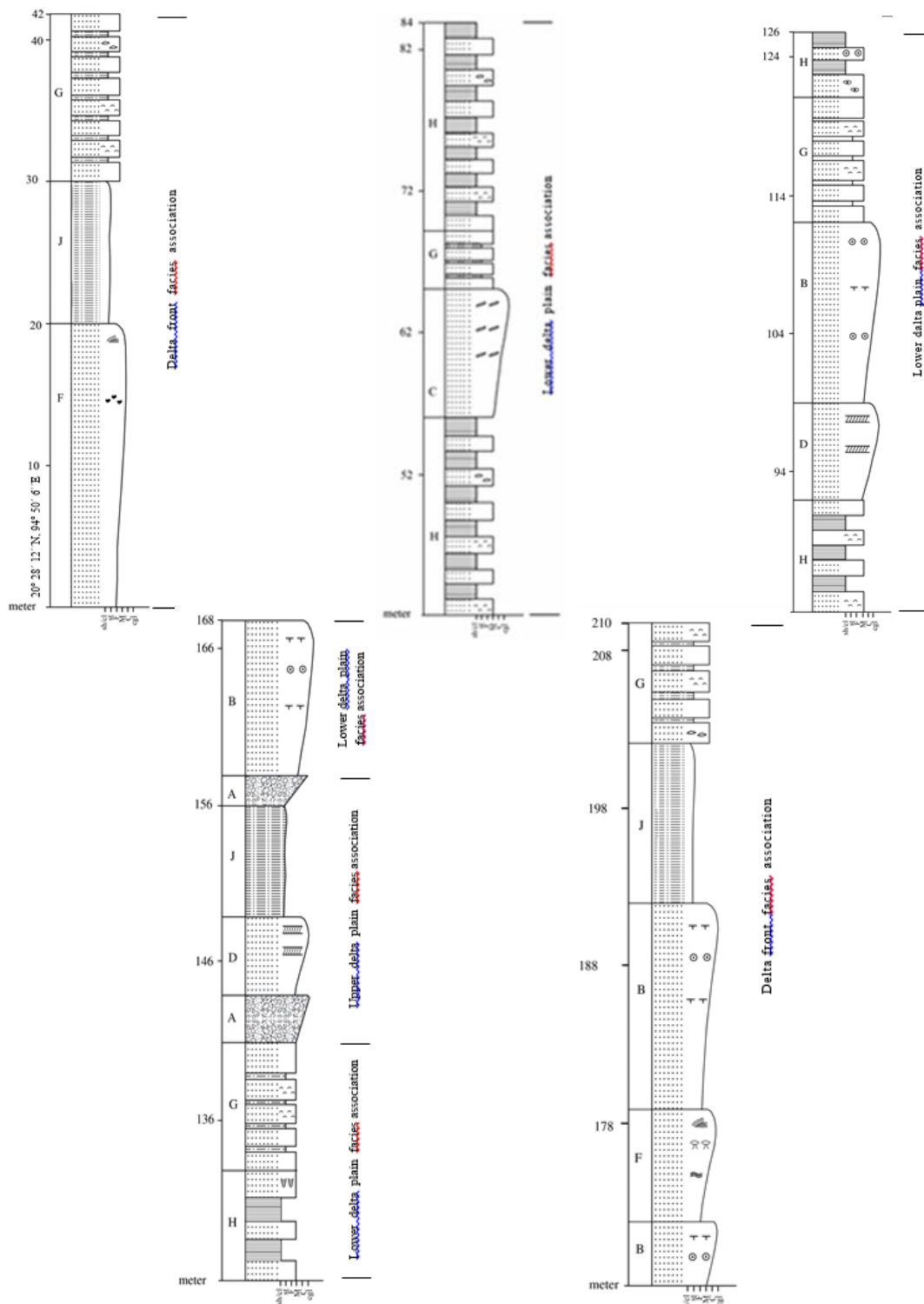


Figure 13.(a) Columnar section of Kyaukkok Formation exposed at Yenangyaung Area.

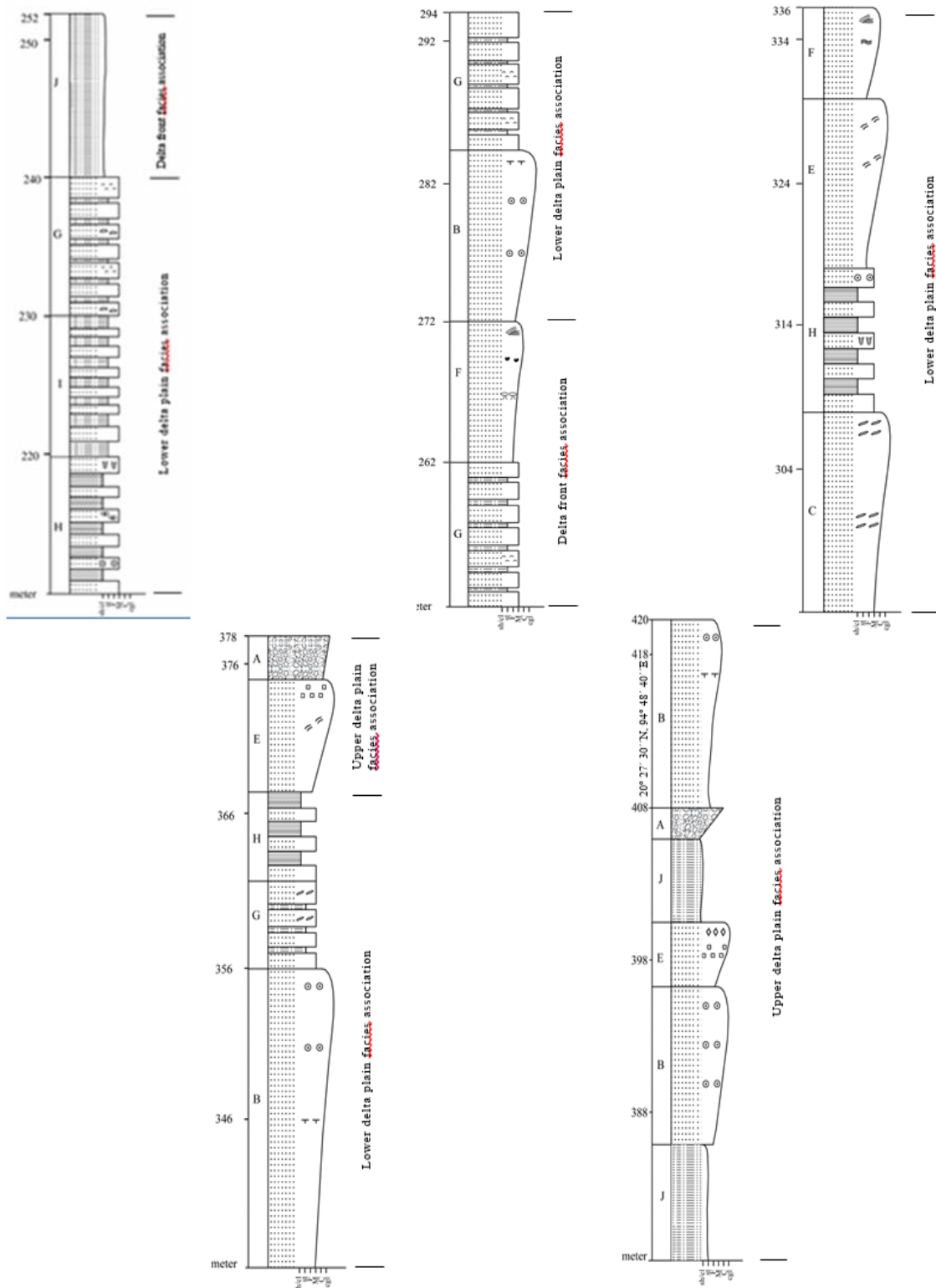








Figure 13.(b) Columnar section of Kyaukkok Formation exposed at Yenangaung Area

Explanation

















Lithology

	Conglomerate
	Sandstone
	Siltstone
	Shale
	Clay

Grain Size

	sh/cl	Shale/Clay
	St	Silt
	F	Fine-grained sand
	M	Medium-grained sand
	C	Coarse-grained sand
	cgl	Pebble-granule

Sedimentary Structure

	Flaser bedding		Dish and pillar structure
	Lenticular bedding		Cone-in-cone structure
	Wavy lamination		Shell fragments
	Ripple lamination		Concretionary clay
	Planar type cross-bedding		Mica band
	Gypsum plate		Sulphur band
	Concretion		Mud clasts
	Hummocky cross stratification		Highly jointed

Conclusion

The study area is situated in Magway Region. It lies between North Latitude 20° 25' to 20° 33' and East Longitude 94° 50' to 94° 58' and falls in one-inch topographic maps of 84 L/14 and 84 L/15. There are two lithostratigraphic units exposed in the study area namely Kyaukkok Formation and Irrawaddy Formation. The contact between these two Formations is unconformable and marked by a distinct ferruginous layer called "Red Bed". The present study mainly emphasizes on the facies analysis of Kyaukkok Formation to interpret the depositional environment. The classified ten lithofacies and three facies associations of Kyaukkok Formation indicate the wave influenced delta front, tidal influenced lower delta plain associated with shoreface, and fluvial dominated upper delta plain environments.

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