DEPOSITIONAL ENVIEONMENT AND LITHOFACIES ASSOCIATION OF THE KANGYIGON CHAUNGSHE AREA, NYAUNG OO TWONSHIP, MAGWAY REGION

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Abstract

The Tertiary molassic sediments exposed in the Kangyigon Chaungshe area is covering about 19.5 square miles and situated between N 21˚1′ to 21˚3′ 30˝ and E 94˚57′ to 95˚0′. It falls in 84K/16 one inch topographic map. The area is mainly composed of sandstone, clay, shale and conglomerate in order of abundance. The stratigraphic succession in descending order is Padaung Formation and Shwezettaw Formation which are the age of Oligocene. On the whole, the petrographic characters of these formations are generally the same and fall within the same field of arkosic composition. Thus, only the stratonomic characters and primary sedimentary structural assemblages can differentiate one formation to another. On the basis of its distinctive lithologic features including color, bedding, composition, texture, fossils and sedimentary structures, at least 15 lithofacies has been recognized in the study area. In the Paleogene sequence of the area, at least three lithofacies associations has been established, delta plain, delta front and prodelta. The former two are concerned with Shwezetaw Formation and the latter one combined with delta-front (Subaqueous topset) is responsible for Padaung Formation. According to the field evidences and facies model, the depositional environments for Shwezettaw and Padaung Formations are deltic environments.

Keywords: lithofacies, facies associations, delta plain, delta front, Prodelta

Introduction

Location and Accessibility

The study area is located about nine kilometers south of Nyaung-U and about eight kilometers south-east of Pagan. It lies between North Latitude 21° 3' 00˝ to 21° 00' 30˝ and East Longitudes 94° 57' 00˝ to 95° 00' 30˝, covering part of one inch topographic map of 84 K /16. The location of the study area is shown in (Figure.1).

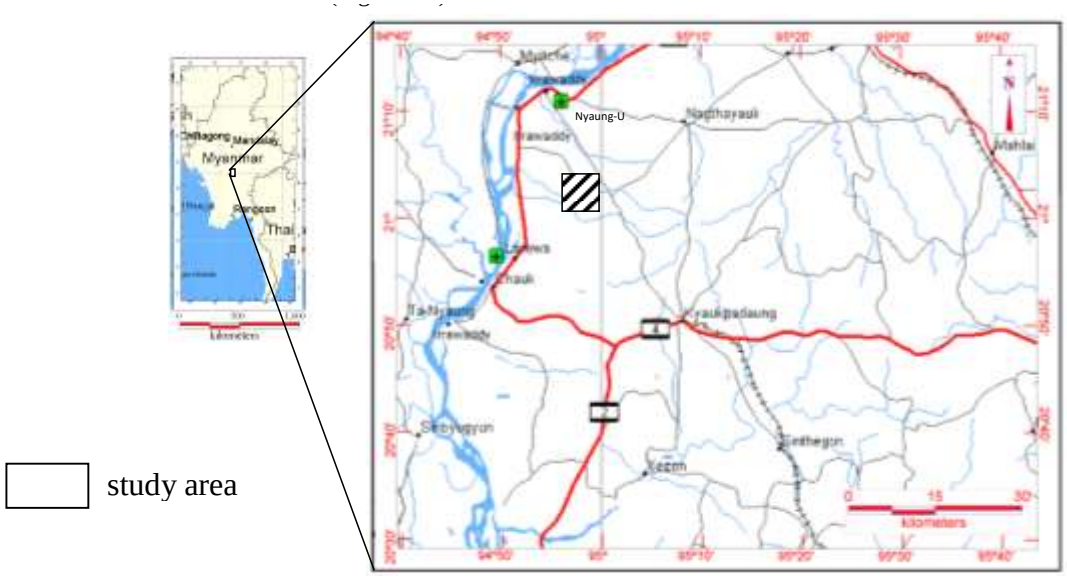

Figure 1 Location map of the study area.

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Methods of Study

Before going to the field literature and topographic maps were studied as a base. One-inch topographic map 84K/16 was used as a base map. As a result, the trend of outcrops, faults and folds are checked thoroughly and structural data was precisely plotted on it. In order to make the facies analysis and to construct the facies model of each unit, detail records of stratigraphic measurements were undertaken along Seikwa chaung in which the best rock units of Shwezettaw and Padaung Formations are well exposed for the purpose of facies analysis.

General Statement

The Kangyigon - Chaungshe area is located in the eastern part of the Minbu Basin within the Centre Cenozoic Belt. It is essentially composed of the clastic sedimentary rock-units of the Cenozoic age, consisting of sandstone, clay, shale and conglomerate (in order of abundance). The rock-units of the area in ascending order are Shwezethaw formation (Early Oligoene) and Padaung formation (Middle Oligocene).

Result

Description of Facies

Facies A (Thick-bedded to massive, grain supported conglomerate)

Its lower contact is sharp, commonly flat and erosional. It consists of crowed gravelly clasts mainly intrabasinal arrangement along an erosional plane (Fig.2). The clasts mainly of pebble-size, the geometry of this facies is variable, so are internal organization, composition and thickness. They are chiefly composed of mud clasts, fossils, and shell fragments. This facies is well developed in the Shwezettaw and Padaung Formations. It may be interpreted as the base of distributary channel deposits or lag deposits (Reading, 1996).

Facies B (Thick-bedded to massive, gritty sandstone)

In this facies, sub rounded to rounded gravelly clasts in a sandy matrix are simple in composition, sorted and faintly imbricated (Fig.3). Its contact is commonly gradational. It is developed in the Shwezettaw and Padaung Formations and is assigned to have deposited in distributary mouth bar and channel fill.

Facies C (Trough cross- stratified sandstone)

It occurs as grouped trough-shaped cross-bedding sets (Fig.4). Its lower contact is sharp and erosional. It is assigned to have deposited in an upper flow regime (see also Reineck & Singh 1980) and in the distributary channel deposits and distributary mouth bar deposit of delta front environments (Reading, 1996).

Facies D (Massive or crudely bedded sandstone, moderately sorted to sorted)

The surface portion of the facies exhibits solution pits and holes due to the removal of concretions and numerous iron nodules (Fig.5) are remarkably recognized and is assigned to be deposited in the distributary channel and mouth bar of delta front environment influenced by fluvial sedimentation (Reineck & Singh (1980), Reading (1996) and Campbell (1967). This facies is clearly seen not only in the upper part of Pandaung Formation but also in the upper and lower sandstone members of Shwezettaw Formation.

Facies E (Planar cross-stratified sandstone)

The contact is sharp, erosional. It is well developed in Shwezettaw Formation (Fig.6). This facies is gradually succeeded by horizontal stratified sandstone (Facies F) and may be assigned to have been formed in the distributary channel and distributary mouth bar deposits of delta front environment (Reading,1996 and Reineck & Singh, 1980), and channel fill deposits of the marsh and river channel deposit (Reineck & Singh, 1980).

Facies F (Horizontal-laminated sandstone)

This facies is developed in fine to medium grained sandstone and it is characterized by the presence of horizontal laminations (Fig.7). The contact is sharp, either flat or slightly concave. This facies is also developed in Shwezettaw and Padaung Formations. It may be interpreted to have been formed in lower and upper flow regime (Reineck & Singh, 1980).

Facies G (Ripple-laminated sandstone and / or siltstone)

They are formed in the upper part of the Shwezettaw Formation (Fig.8). They consist of alternating very thin beds of fine-sand, shale and siltstones. They belong to lower flow regime (Reineck & Singh, 1980) and may be assingned to have been deposited in subaqueous levees, distributary mouth bar deposits. The contacts are commonly sharp and non-erosional.

Facies H (Thin to medium bedded sandstone with wavy bedding)

In this facies, mud and sandy layer alternate and form continuous layers. The contact is commonly gradational and erosional (Fig.9). The genesis of this facies requires conditions where the depositionand preservation of both sand and mud are possible (Reineck & Singh, 1980). The facies is commonly associated with Facies E, F and M and only found in Shwezettaw Formation. This facies may be assigned to have been deposited in environment of subaqueous levee deposits of delta.

Figure 2 Facies (A) Intraformational conglomerate in Padaung Formation (N 21º 00' 23" E 94º 59' 42")

Figure 3 Facies (B) Thick bedded to massive gritty sandstone in Padaung Formation (N 21º 00' 24" E 94º 59' 47")

Figure 4 Facies (C) Trough cross-stratification in buff color massive sandstone of Shwezettaw Formation (Tin Aung Myint, 2001) (N 21° 02' 26" E 94 57' 51")

Figure 5 Facies (D) Massive or crudely bedded sandstone in Shwezettaw Formation. (N 21° 00' 23" E 94° 59' 47")

Figure 6 Facies (E) Large scale planar cross stratified sandstone in Shwezettaw Formation **(**N 21° 00' 24" E 94º 59' 47")

Figure 7 Facies (F) Horizontal (or) parallel bedding in Padaung Formation (N21º 02' 32" E 94º 57' 52")

Facies I (Thick- bedded silty sandstone with lenticular bedding)

In this facies, the ripples or sandstone lenses are discontinuous and sometimes isolated in nature both in vertical and horizontal directions (Fig.10). According to Reineck and Singh (1980), near the delta front environment, sediments are more silty and parallel and lenticular laminations are common. Thus, this facies is commonly associated with horizoantal laminated Sandstone (Facies D). Therefore it should be assigned to the prodelta association (Reineck & Singh, 1980).

Facies J (Hard and compact sandstone)

This facies is characterized by fine-to coarse-grained sandstone (Fig11). The contact is commonly sharp, flat and non-erosional. This facies is commonly associated with facies M, N, O and distributed in Padaung Formation. It may be interoreted as prodelta.

Facies K (Thin to thick bedded structureless sandstone)

This facies consists of thin to thick bedded structureless sandstone and has 0.1 to 2 m in thickness (Fig.12). The contact is sharp and erosional. They are well-developed in Shwezettaw Formation. It is associated with Facies D,G,N,O. It may be assigned to be deposited in channel fill and distributary mouth bar deposit of delta.

Facies L (Thin to medium bedded, sand, silt and clay or mud interbeds)

In this facies, thin to medium bedded sand, silt and clay or mud are interbedded with different thickness (Fig.13) The contact is sharp and erosional. It is developed in Shwezettaw Padaung Formations. This facies may be assigned to be deposited in distributary mouth bar and prodelta.

Facies M (Thin laminated silt and silt clay with thin-bedded sandstone)

In this facies, internally laminated silt and silty clay are present (Fig.14). It is very common in all formations and it is variable in relationship with associated facies. It may be assigned to be deposited in the prodelta and distributary channel (see also Reineck and Singh, 1980). The contact is sharp and gradational.

Facies N (Shale or silty shale with thin bedded sandstone)

In this facies, internally laminated shale or silt shale are present (Fig.15). Its contact is sharp and gradational. It is also developed in Shwezettaw and Padaung Formations. This facies may also be interpreted to have been deposited in prodelta and distributary channel.

Facies O (Massive clays and mudstone)

This facies is characterized by fine grained sediments mainly clay and silty clay (Fig.16). They are commonly bluish grey to buff in color. They are usually friable and massive but sometimes show layering. The thickness ranges up to 25 m. Sometime they show homogeneous beds and are likely to be formed by organic process, inorganic process and grain flow (Reineck & Singh, 1980). The contact is commonly sharp and erosional. This facies may also be interpreted to have been deposited in prodelta, distributary channel and well drained swamps environment (Reineck and Singh, 1980 & Reading, 1996).

Lithofacies Association

At least 3- lithofacies associations can be established in the Paleogene sequence of the study area. They are delta plain (subaerial topset), delta front (subaqueous topset) and prodelta.

Delta plain (subaerial topset) Association

Delta plain (subaerial topset) deposits are marsh and river channel deposits (Reineck and Singh, 1980). In the present work, the association can be correlated with well-drained swamp deposit, channel fill and subaerial levee deposit of "The Swamp Deposits of the Atchafalaya Basin" proposed by Coleman (1965).

Figure 8 Facies (G) Possible bifurcated ripple laminated sandstone of Shwezettaw Formation (N 21^{o} 02' 56" E 94^{o} 57' 36")

Figure 9 Facies (H) Thin-to medium-bedded sandstone in Shwezettaw Formation. (N 21^{o} 2' 51" E 94^{o} 58' 03")

Figure 10 Facies (I) Thick bedded silty sandstone with lenticular bedding in Padaung Formation. (N 21º 2' 26" E 94º 57' 51")

Figure 11 Facies (J) Thin-to medium-bedded, hand and compact sandstone in Padaung Formation (N 21º 02' 20" E 94º 57' 52")

Figure 12 Facies (K) Thin-to thick-bedded structure less sandstone in Shwezettaw Formation. (N 21º 02' 50" E 94º 58' 02")

Figure 13 Facies (L) Thin-to medium-bedded sand, silt and clay (or) shale interbeds (upper and lower) in Shwezettaw Formation (N 21º 00' 22" E 94º 59' 43")

Figure 14 Facies (M) Thin laminated silt and silty clay with thin-bedded sandstone in Padaung Formation (N 21º 02' 50" E 94º 58' 03")

Figure 15 Facies (N) Shale or silty shale with thin-bedded sandstone in middle Shwezettaw Formation (N 21º 02' 20" E 94º 57' 57")

Figure 16 Facies (O) Massive clay sequence in Padaung Formation (N 21º 03' 02" E 94º 57' 55")

According to Reineck and Singh (1980), channel fill deposits are made up of coarser and poorly sorted sediments than the adjoining deposit. Deposition in the channel takes place by the migration of point bars and braid bars. This association represents sedimentation in stream channels that have been abandoned by a stream because of cut-off process or avulsions (Reineck & Singh, 1980). Moreover, various sizes of large-scale planar type cross-beddings are the most common features of this deposit. Thus, in the study area, channel fill deposit may be the combination of facies B, D, E, H and K because of the lack of lenticular bedding and parallel bedding.

Wood-chips, leaf imprints, structureless sandstone of facies K and planar cross-stratified sandstone of Facies E are only the indicators of channel fill deposit According to Reineck and Singh, (1980), subaerial levee deposit show current ripple and ripple beddings. Irregular lamination is very common. Unfortunally, current ripple is hardly to find in the area. However, common irregular laminationis horizontal laminated sandstone of facies (F) which are due to interference by grass roots in sedimentation (Reineck & Singh, 1980). Iron nodules and carbonate nodules are abundant. Thus Facies of D, E, F, K, L, M, N revel that it is through to be assumed the subaerial levee deposit. This deposits are associated with channel fill deposit. Moreover, the calcium carbonate which is also concentrated along bedding and low organic matter is present in Facies O. Thus it is reasonable to say that those facies are throught to be assumed as well drained swamp deposits.

Therefore in general, most of the lower part of Shwezettaw Formation is subaerial topset deposit. In the Shwezettaw Formation, due to the present of gypsum deposits, this facies association is deposited in the arid climate.

In short subaerial topset association which is occurred at the lower part of the Shwezettaw Formation generally consist of thick-bedded to massive grity sandstone, Facies B, massive or crudely bedded structureless sandstone, Facies D, planar cross-stratified sandstone. Facies E, thin to thick-bedded structureless sandstone. Facies K, sand/shale interbeds Facies L, thinly laminated silt and silty clay Facies M, shale or silty shale facies N, massive clays and mudstone Facies O.

In this respect, it is reasonable to conclude that during the progradation of delta, fluvial-influnced sedimentation had occurred in this sequence.

Delta front (subaqueous topset) Association

In fact, subaqueous topset deposits are delta front deposits including channel deposits, natural levee deposits and flood basin deposits and, thus, these are accumulation almost entirely under the influence of fluvial processes. The most common sedimentary structures in the distributary channel deposit are cross-beddings, scour-and-fill structures and erosional surfaces. Intraformational deformation structures such as slump structures are commonly found (Reineck & Singh, 1980). Thus, this feature may be present in the thinly laminated silt and silty clay with thin bedded sandstone of (Facies L) in the area.

As the channel flame s out downstram, current direction become variable and current velocity is reduced. Thus, rate of deposition of sediments is increased. In the view, the significant coarse-grained facies such as A, D are thought to be considered as distributary channel. Another factor is that, the most common sedimentary structures like cross beddings, current ripples and erosional surfaces which are present in the study area are the best indicator of this deposit. In this respect, Facies of D,C, E, F, M & N may be distributary channel deposits.

Subaqueous levees are the submarine ridges broadening and shoaling of the channel. Locally combined current and wave action produce complex type of cross bedding (Reineck & Singh, 1980). The determination of planar cross-bedding (Facies, C) which angle is 30˚ points out the current actions. However, ripple-laminated sand or siltstone (Facies, F) is occurred, pointing

out the wave action as the presence of bifurcation. Thus, in the area both current and wave actions happened in subaqueous topset sequence. The distinct wavy bedding (Facies, H) occurred in the middle part of Shwezettaw Formation and burrows in (Facies, D, K, O) point out the characteristic features of subaqueous levees.

Distributary mouth bar ia a sandy shoal formed near the seaward limit of the distributary channel. The role of sedimentation is exceotionally higher than in any gritty sandstone-Facies B are the distinctive features of this mouth bar. In short, the middle and upper paart of Shwezettaw Formation and the upper sand capping of Padaung Formation belong to the subaqueous topset sequence.

In conclusion, the general accepting of subaqueous topset association includes conglomerate; Facies A, through cross-bedded; Facies E, horizontal laminated silty clay; Facies; M, silty shale; Facies N, and massive clay; Facies O.

Prodelta Association

This facies association represents the region seaward of the delta front environment which is closely associated with the prograding delta system. This facies association is characterized by fine-grained muddy sediments of massive clay (Facies O), shale or silty shale (Facies N). This prodelta deposits are transitional into the shelf-mud deposit. Near the delta-front environments, the sediments are more silty and parallel and lenticular beddings are common. Thus, lenticular bedding (Facies I) and horizontal laminated sandstone (Facies F) are the belt examples for the prodelta association. Sediments show layering due to difference in both colour and grain size. This thinly laminated silt and clays are the most noticeable features in prodelta association.

Localized hard and compact sand of (Facies J) are occurred in it. It is overlain by the thin the medium bedded sand-silt and clay or mud interbed (Facies L), laminations are common. These are eventually represent by (Facies L, D, F). Thus, in prodelta environment, clays predominate and mostly colour layering predominates in it. Shell remains and wood fragments are also present. Thus, Facies of B, N and O are indicative of prodelta association.

Summary and Conclusion

The Tertiary molassic sediments exposed in the Kangyigon Chaungshe area is covering about 19.5 square miles and situated between N 21° 2′ to 21° 8′ and E 94° 57′ to 95° 0′. It falls in 84K/16 one inch topographic map. The area is mainly composed of sandstone, clay, shale and conglomerate in order of abundance. The stratigraphic succession in descending order is Padaung Formation and Shwezettaw Formation which are the age of Oligocene. On the whole, the petrographic characters of these formations are generally the same and fall within the same field of arkosic composition. Thus, only the stratonomic characters and primary sedimentary structural assemblages can differentiate one formation to another. On the basis of its distinctive lithologic features including color, bedding, composition, texture, fossils and sedimentary structures, at least 15 lithofacies has been recognized in the study area. In the Paleogene sequence of the area, at least three lithofacies associations has been established, delta plain, delta front and prodelta. The former two are concerned with Shwezetaw Formation and the latter one combined with delta-front (Subaqueous topset) is responsible for Padaung Formation. According to the field evidences and facies model, the depositional environments for Shwezettaw and Padaung Formations are deltic environments.

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