

SEDIMENTARY STRUCTURES OF NEOGENE CLASTIC SEDIMENTS EXPOSED AROUND TAUNGTHA-MYINGYAN AREAS, MANDALAY REGION

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Abstract

The current research area is located around Taungtha-Myingyan areas. The main objective is to describe the sedimentary structures on the bedding planes of Neogene clastic sediments from field observations and to estimate the possible depositional environments based on sedimentary process and condition. It is composed of light grey, reddish brown to buff coloured, fine to medium grained, thin-medium to thick-bedded, sandstones, shale and silty clay interbeds. The various types of sedimentary structures of Neogene clastic sediments include ripple marks, planar cross-bedding, bi-directional cross-bedding, parallel lamination, load cast, flute cast, mud clasts, concretions, cone-in-cone structure, convolute lamination, herringbone cross-bedding, hummocky cross-stratification, wavy bedding, lenticular bedding and flaser bedding. The possible depositional environments may be suggested as tide and wave deltaic and fluvial environments. This research provides the paleocurrent, paleoclimate, paleoecology and paleogeography for sustainable natural resource management.

Keywords: Neogene clastic sediments, possible depositional environments, the various types of sedimentary structures.

Introduction

The Neogene clastic sediments in the current research area are exposed car-road section, stream section, cart-road section around Taungtha-Myingyan areas. It is composed of light grey, reddish brown to buff coloured, fine to medium grained, thin-medium to thick bedded, sandstones, shales and silty clay interbeds with types of ripple marks, planar cross-bedding, bi-directional cross-bedding and mud clasts. The main drainage pattern exhibits coarse to fine dendritic drainage and subparallel drainage patterns. The main objective is to describe the sedimentary structures on the bedding planes of Neogene clastic sediments and to estimate the possible depositional environments using field evidences. The current research area is accessible by appropriate vehicles all year. The field data had been collected in 2022-2024 years. The location map of the current research area is shown in Fig.1.

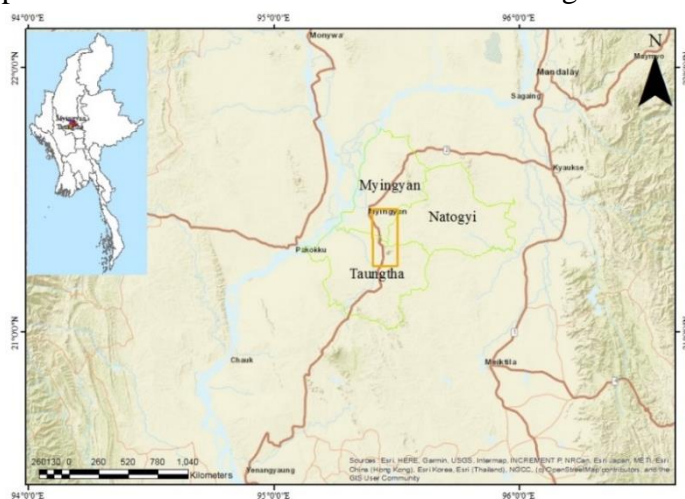


Figure 1 Location Map of current research area, Mandalay Region (Source: Arcgis Online Base Map).

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Regional Geologic Setting

In Myanmar, there are four north-south linear geotectonic provinces; namely from east to west – Eastern Highland, Central Cenozoic Belt, Western Ranges, and Rakhine Coastal Belt.

The Central Cenozoic Belt consists of depositional basins and uplifts trending longitudinally (Maung Thein, 1976). It can be subdivided into five basins; Hukwang Basin, Chindwin Basin, Minbu Basin, Pyay Basin and Ayeyarwaddy Delta Basin, and four uplifts; Kumon Ridge Uplift, Wuntho Mass Uplift, Salingyi Uplift and BagoYoma Uplift (Maung Thein, 2014).

The study area is located on the Central Cenozoic Belt (Chhibber, 1934; Maung Thein, 1976) which constitutes one of the four geotectonic belts of Myanmar. The Central Cenozoic Belt is mainly composed of clastic sedimentary rocks of Cenozoic age under deltaic and fluvial condition. Neogene sediment of the Pegu Group and Irrawaddy Formation is found in the Central Cenozoic Belt. It is divided into the eastern and western troughs.

The eastern trough can be subdivided into the three parts: the northern, middle, and southern parts. The northern part is represented by Sadwingyi area. The middle part is occupied by the Monywa-Kyaukpadaung region and the southern part by the Bago Yomas. The study area under the present investigation is included in the Monywa-Kyaukpadaung Region, the middle part of the eastern trough. In this part of the region, the Miocene rocks are exposed in the form of inliers forming anticlinal ridges among the late Tertiaries. Regional Geologic Setting Map and Neogene Basin Map of the study area are shown in Fig.2.

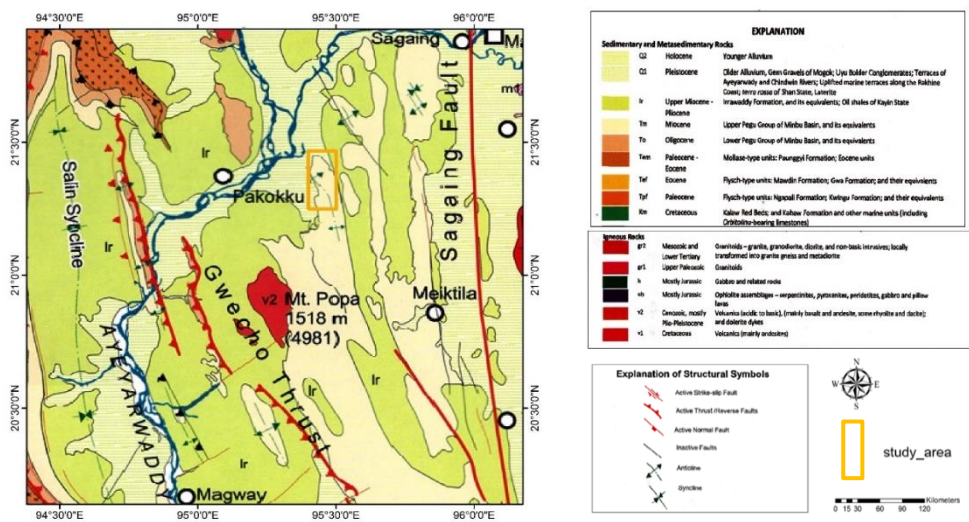


Figure 2 Regional Geological Map of current research area, Mandalay Region (Source: Myanmar Geoscience Society,2014).

Method of Study

The current research area has been done to take the writing from my Ph.D geology research work of field observations and from combination facts with the field research works of previous workers (Fig.3).



Figure 3 Flow Chart of current research area.

Results

The current study area is located in the Back-arc basin of the Central Cenozoic Belt. The Neogene sediments are named by previous workers such as Pegu Group and Irrawaddy Formation (Aung Khin and Kyaw Win, 1969); Khabo Sandstone, Moza Formation, and Taungtalon Formation (Myint Thein, 1966); Taungtha Formation (DD Sarin, 1964, Khin Khin Lin, 1999) after the type locality and stratigraphic principles and nomenclature. The Neogene clastic sediments are light yellowish grey, greenish grey to reddish brown, fine to medium grained, medium to thick-bedded, interbedded sandstones, siltstones and shales. The sedimentary structures are important to describe top and bottom of bedding plane, paleocurrent direction and possible depositional environments. The types of sedimentary structures are (i) erosional structures such as load cast and sole marks, (ii) depositional structures such as ripple marks, cross-bedding and lamination, (iii) deformational structures such as convolute laminations, desiccation cracks, (iv) biogenic structures. These sedimentary structures are occurred in Taungtha-Myingyan car-road section, Taungttha hill car road section and stream sections.

The erosional sedimentary structures of Neogene clastic sediments are distributed in Taungtha and Nanmyint hills cart road section, Shwephonepwint cart road section, and consists of load cast, flute cast, mud clasts and intraformational conglomerates (Fig.4).

The depositional sedimentary structures of Neogene clastic sediments are cropped out in Taungtha-Myingyan car road section and stream section. It includes types of ripple marks, planar cross-bedding, cross-lamination, parallel lamination while tidal structures are flaser-lenticular and wavy beddings, herringbone bedding, bi-directional cross-bedding and hummocky cross-stratification. (Fig.5-6-7).

The deformational sedimentary structures of Neogene clastic sediments are exposed in the Taungtha-Myingyan car road section and stream section. It has been occurred as convolute lamination, cone-in-cone structures and concretions (Fig.8).

The biogenic sedimentary structures of Neogene clastic sediments are observed in Taungtha and Nanmyint hills cart-road section, Shwephonepwint pagoda cart-road section (Fig.9). From above data and facts, the possible depositional environments may be tide-dominated delta or estuarine and fluvial environments. Therefore, the depositional environment of Neogene clastic sediments of current research area is tide-dominated delta or estuarine and fluvial environments based on stratigraphic measurement section of the study area (Fig.10,11).

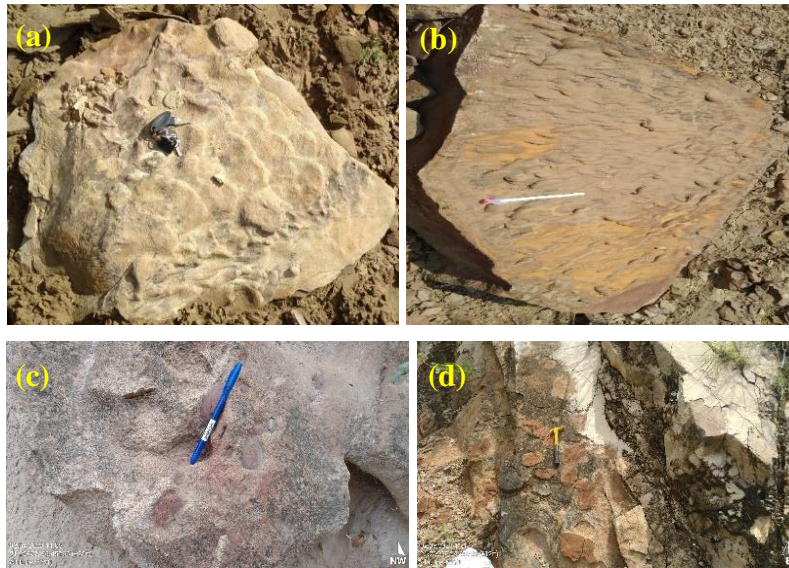


Figure 4 Erosional sedimentary structures of Neogene clastic sediments (a) light yellowish grey, thin-bedded, load cast sandstone at Moehanaingkhine village cart-road section and (b) light yellowish grey, thin-bedded, flute cast sandstone at Taungtha hill cart road section, (c) reddish brown, intraformational conglomerate sandstone, (d) red mud clast sandstone at Shwephonepwint pagoda cart-road section.

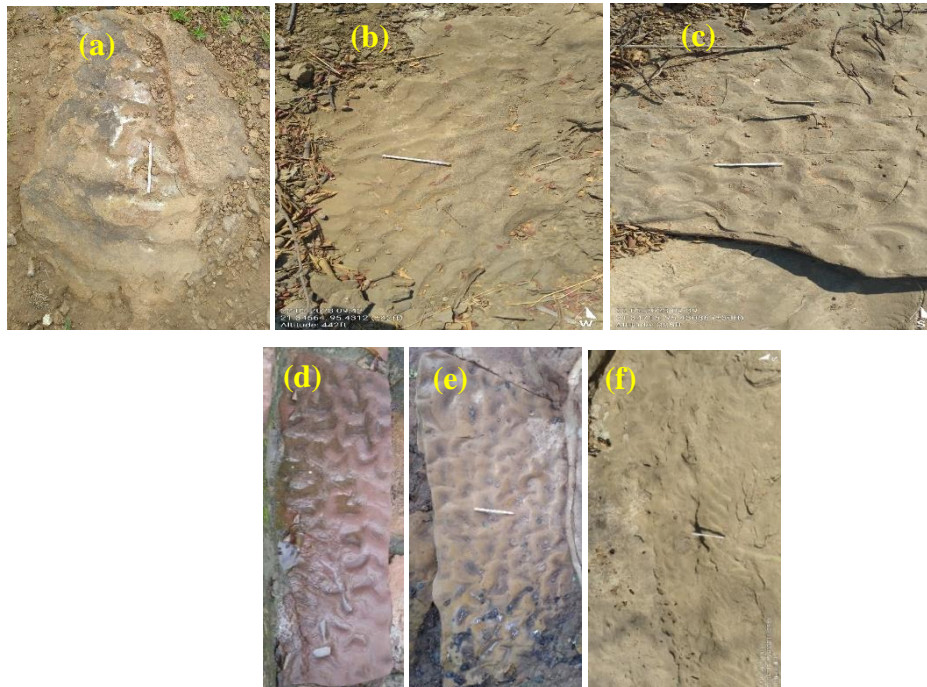


Figure 5 Depositional sedimentary structures of Neogene clastic sediments: types of ripple marks in fine-grained, sandstone (a) straight sinuous ripple mark, (b) bifurcated ripple mark, (c,d,e) linguoid ripple marks, (f) small scale straight ripple mark at the Nanmyint hill sections.



Figure 6 Depositional sedimentary structures of Neogene clastic sediments (a) planar cross-bedding at Ku village cart-road section (b) trough cross-bedding at Taungtha dam.

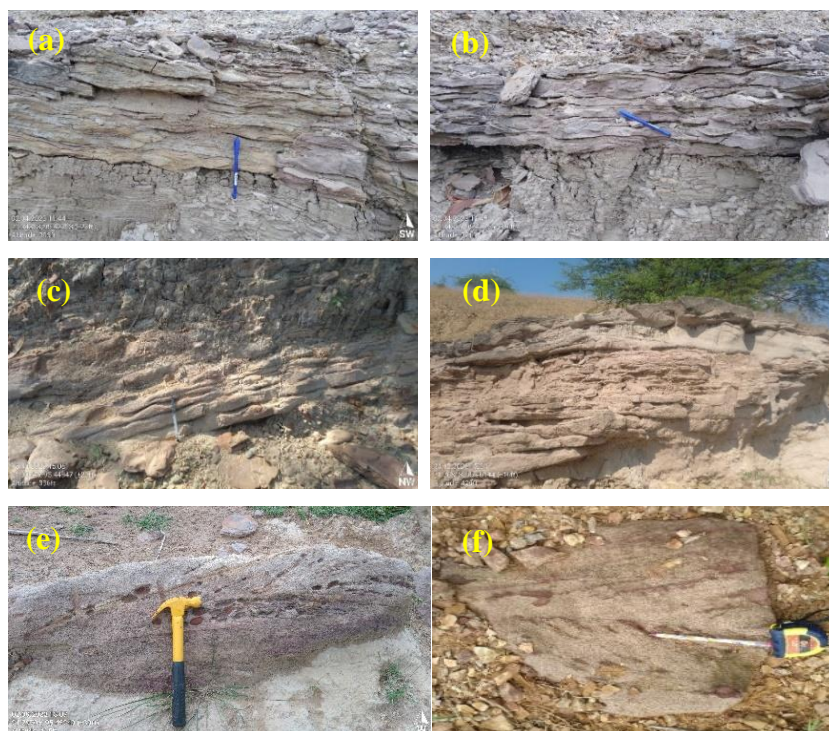


Figure 7 Tidal sedimentary structures of Neogene clastic sediments (a) flaser bedding, (b) wavy bedding, (c) lenticular bedding, (d) hummocky cross-bedding (e) bi-directional cross-bedding (f) herringbone cross-bedding at Taungtha-Myingyan car road section, Minkan hill and stream section.



Figure 8 Deformational sedimentary structures of Neogene clastic sediments (a) concretions, (b) cone-in-cone structures at Taungtha-Myingyan car road section and Taungtha hill section.



Figure 8 Deformational sedimentary structures of Neogene clastic sediments (c) syneresis cracks, (d) convolute lamination at Taungtha hill, Taungtha-Myingyan car road section and stream section.



Figure 9 Biogenic sedimentary structures of Neogene clastic sediments: (a) Honeycomb network *Paleodictyon sp.*, trace fossil bearing sandstone (Ordovician-Tertiary), (b) *Zoophycos sp.*, trace fossil bearing sandstone (Cambrian-Holocene), (c) reddish brown, thin bedded, bioturbated sandstone (*Helminthoida sp.*, Mississippian to Tertiary), (d) Silicified fossil wood bearing sandstone (Miocene-Pliocene) in the middle part of Taungtha hill section and Myaephyugone village.

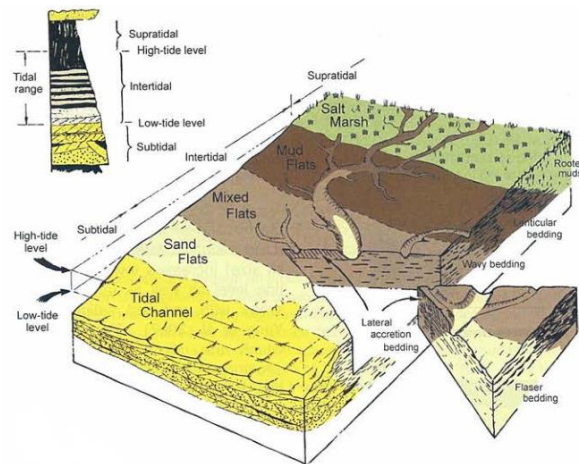


Figure 10 Depositional Environments of Neogene clastic sediments in Taungtha-Myingyan areas (modified after Dalrymple et.al., 1990 in Walker, 1992).

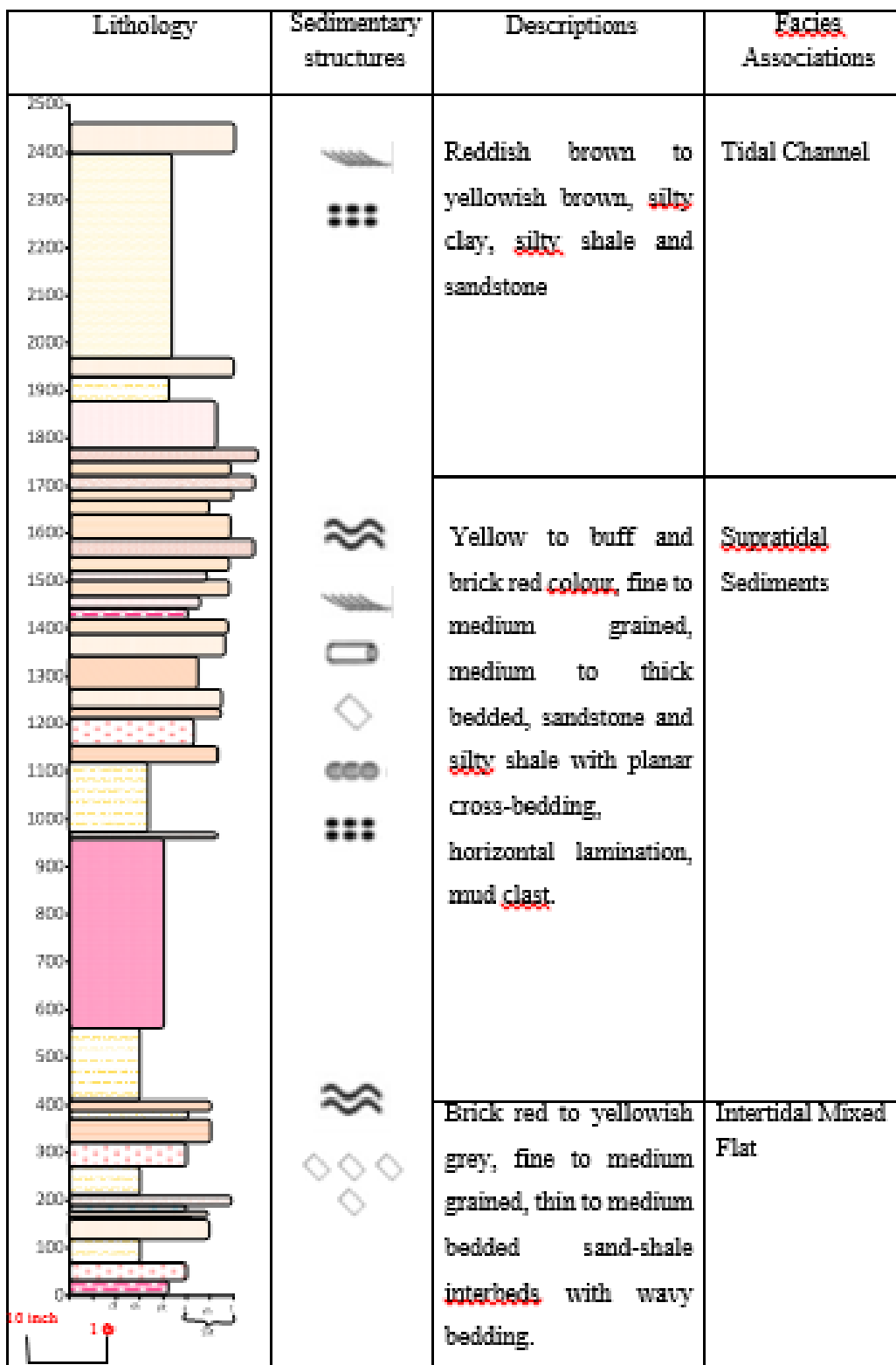


Figure 11 Stratigraphic Measurement Section of Moza Formation at the middle part of Shwephonepwin pagoda cart-road section (from 21.30037N, 95.4539E to 21.29787N, 95.45225E) (stratigraphic thickness=228feet).

Conclusion

The current study area is located at Bark-arc basin in the Eastern Trough of Central Cenozoic Belt. The Neogene clastic sediments are light yellowish grey to reddish brown, fine to medium grained, medium to thick-bedded, interbedded sandstones, siltstones and shales. The types of sedimentary structures are (i) erosional structures such as load cast, (ii) depositional structures such as ripple marks, cross-bedding and lamination, (iii) deformational structures such as convolute laminations, desiccation cracks, (iv) biogenic structures such as trace fossils and fossil wood. Based on these observations, the possible depositional environments may be tide-dominated delta or estuarine and fluvial environments. These Neogene clastic sedimentary structures of current research area reveal paleoclimate and paleocurrent directions (NNW-SSE trending), paleogeography and paleoecology to provide insights for future research work and sustainable natural resource management.

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