Grain Size Distribution of the Damapala Formation of the Powintaung Area, Yinmarbin Township, Sagaing Region

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Abstract

The study area is situated in Yinmabin Township, Sagaing Region. It lies in the Lower Chindwin Basin. The present work investigates the grain-size patterns of the Damapala Formation of the study area. The Damapala Formation is mainly composed of sandstone, siltstone, mudstone and andesitic volcanic rocks. A total of 24 samples of loose sands from the Damapala Formation were collected and analyzed to obtain grain-size distribution curves (log-probability plots) and a CM pattern. The log-probability plots of the Damapala Formation generally have the bed load population when present is poorly sorted, and truncation generally is finer than 2.0 phi; the size range of the saltation population is from 1.0 to 3.5 phi; and the suspension population is well sorted and usually truncated at a size finer than 3.5 phi. A suspension population has been defined which mostly represents less than 1 percent of the sample. The break in the saltation populations ranges from about 15% to near 80%. The characteristics of beaches all show three or four populations, with two saltation populations. The samples of the Damapala Formation could be deposited by beach process. The CM pattern produced by plotting C (coarsest one percentile) against M (median grain size) of 24 sandstone samples shows wide and long. Points are scattered in the coarser part of the pattern and concentrated in the finer part. The action of the waves is reflected in the size distribution of the finer sediments. There is for each beach a fairly well defined lower limit to the size of the particles which form a large percentage of the samples. The CM pattern of the Damapala sandstone is identical with that of the beach processes.

Keywords: grain-size distribution, log-probability plots, CM pattern, bed load population, saltation, suspension

Introduction

The study area is situated in Yinmabin Township, Sagaing Region (Fig. 1). It lies in the Lower Chindwin Basin which is in the western part of the Central Volcanic Line (CVL). The volcanic occurrences and the associated rocks of this area were mapped by Stamp (1922) and Chhibber described the late Tertiary igneous rocks of the Lower Chindwin region in 1927. Fairly detailed exploration and survey programme was started in 1973-74 by the geologists of OTCA. The petrology of the igneous rocks exposed in the Twin Taung, Leshe area has been studied by Aye Ko (1985). Myo Sann Oo also studied the sedimentology of the Nyaungaing-Obo area in Yinmabin Township, Sagaing Division. Myint Zaw Han (1993) studied the petrology of Kyisin-Sabe and Letpadaung taungs. Min Aung attempted to interpret the geology of Powintaung- Silaung area. Maung Maung Naing (2003) carried out the petrology and mineralization of copper deposits found in this region.

Stratigraphy

General Statement

The study area is composed mainly of igneous rocks and sedimentary rocks. The rock sequence of the study area is divided into, from older to younger; the Basement Complex (Cretaceous), the Wazintaung Formation (Eocene), the Damapala Formation (Late Oligocene to Early Miocene), the Magyigon Formation (Miocene to Pliocene), the Kangon Formation (Pleistocene) and the recent Volcanic and Sediments.

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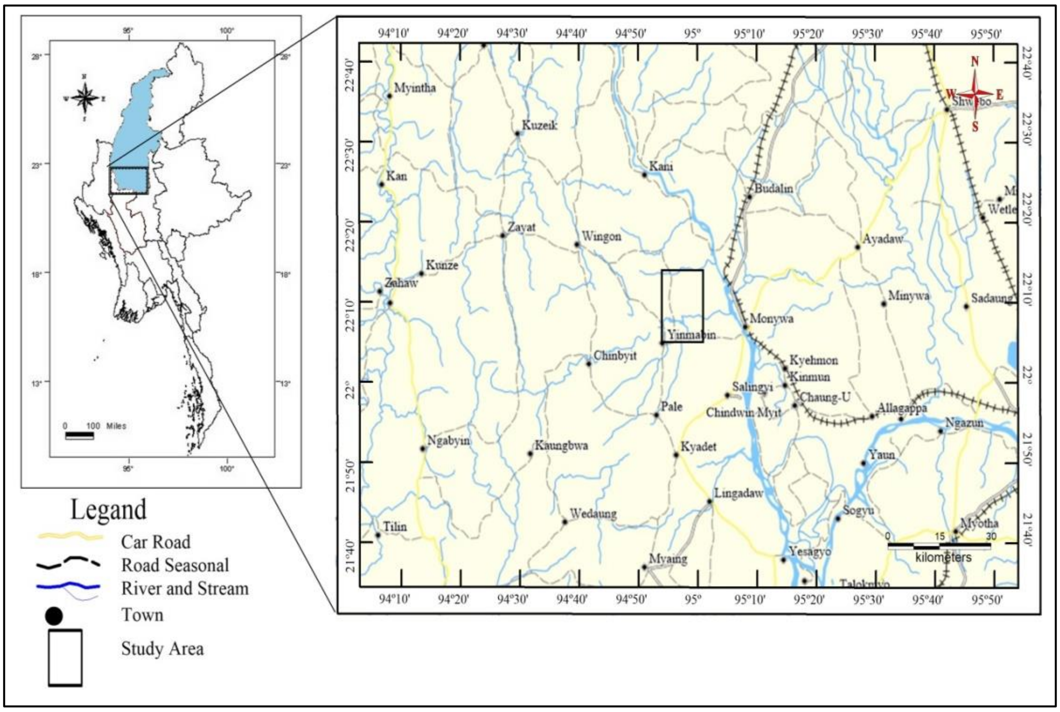

Figure (1). Location map of the study area

Damapala Formation

The term Damapala Formation was firstly defined by OTCA geologists (1973). The Damapala Formation is widely distributed along the Tebingan Chaung, Powintaung and Ingyintaung. The Damapala Formation is mainly composed of sandstone (Fig. 2 & 3), siltstone, mudstone and andesitic volcanic rocks. According to Pascoe (1945) this formation was assigned Late Oligocene to Early Miocene age. Geological map of the study area is shown in (Fig. 4).

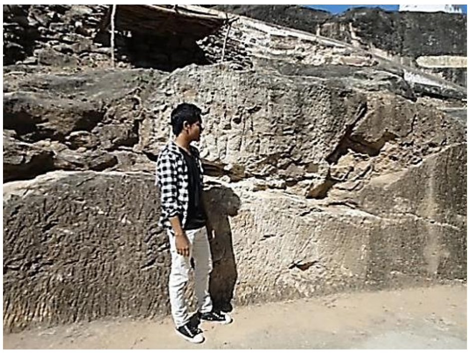

Figure (2). Massive sandstone of the Damapala Formation (Powintaung, Lat. 22˚02′ 28.3″N, Long. 94˚59′23.7″E)

Figure (3). Massive sandstone of the Damapala Formation (Ingyintaung, Lat. 22˚05′ 41.2″N, Long. 94˚58′33.9″E)

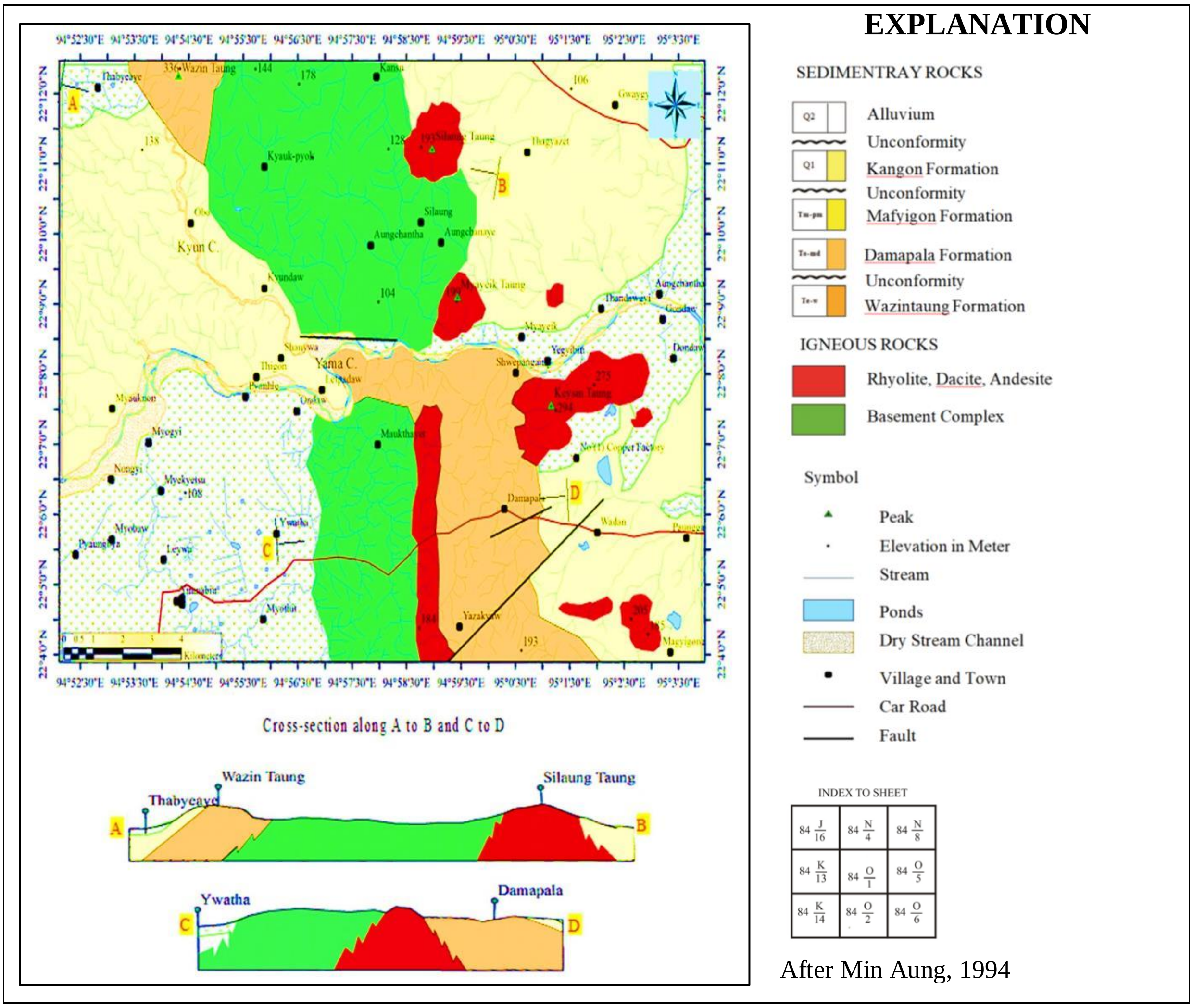

Figure (4). Geological map of the study area

Grain-Size Distribution

General Statement

The grain-size distribution of a sedimentary deposit has been presented graphically in various ways with a view to relating grain-size distribution to sedimentary processes. Among the existing graphical approaches, log-probability grain-size distribution curves of Visher (1969) and CM pattern of Passega (1957) appear to be effective tools for discriminating the modern environments and their ancient analogues. A log-probability grain-size distribution curve, unlike others, consists of straight segments, each being a separate log-normal population. Each population is truncated and joined with the next population to form a single distribution. Each log-normal sub-population may be related to different mode of transport and deposition. The three modes of transport reflected are: (1) suspension; (2) saltation; and (3) surface creep or rolling. According to Visher (1969) the number, size range, mixing and sorting of these populations vary systematically relation to provenance, processes and sedimentary dynamics. The log-probability grain-size distribution curve is said to identify deposits formed under different modes of origin which include: (1) current; (2) wash and back wash; (3) waves; (4) fallout from suspension; (5) tidal currents; (6) turbidity currents; and (7) aeolian dunes.

According to Passega (1957), sample points patterns representing the variations in a deposit of two parameters (C, an approximation of the maximum grain size, and M, the median) are characteristic of the depositional agent. He has produced patterns for sediments of tractive currents, quiet water, beaches and turbidity currents. These CM patterns are generally sharply defined and vary considerably with the type of depositional agent. The CM patterns are a geologic tool which can be used to analyze the deposition of recent sediments and to reconstruct the conditions of deposition of ancient sediments.

Materials and Methods

Altogether 24 samples of loose sands were collected from the Damapala Formation of the study area. The samples collected were later disaggregated and sieved with a Ro-tap machine using B.S sieves placed at one-phi interval for a period of 10 minutes per sample. The results of the mechanical analysis were plotted as cumulative curves on arithmetic probability paper. The granulomeritic data thus obtained were used in the preparation of textural diagrams (a CM pattern and log-probability grain-size distribution curves.

Results and Discussion

Log-Probability Plots of the Damapala Sandstone

The shape of the grain size curves of the samples from the Damapala Formation are shown in (Fig. 5). Most of our curves are again comparable to those of beach deposits as obtained by Visher (1969) (see Fig. 6). The striking characteristics of the majority of the curves are the development of two saltation populations.

Visher has pointed out that the bed load population when present is poorly sorted, and truncation generally is finer than 2.0 phi; the size range of the saltation population is from 1.0 to 3.5 phi; and the suspension population is well sorted and usually truncated at a size finer than 3.5 phi. A suspension population has been defined which mostly represents less than 1 percent of the sample. This population typically ranges from 15% to as much as 80% of the distribution. The characteristics of beaches are from a wide range of physical and provenance conditions. Each size distribution is plotted in identical fashion, and all show three or four populations, with two saltation populations. The reason for this is believed to be related to swash and backwash in the foreshore zone, but other possibilities might include mixing from separate provenances or shape of particles of different size. The position of truncation points is highly variable. The break in the saltation populations ranges from about 15% to near 80%. Also slopes, or sorting, of the various populations are highly variable. The similarity of each of the sands of the Damapala Formation is the development of four populations and two saltation populations. From analysis of the size data, the samples of the Damapala Formation could be deposited by beach process.

CM pattern of the Damapala Sandstone

Passega (1957) suggested the use of CM diagrams for environmental analysis. The CM pattern of the present sandstone has been obtained by plotting C (1 percentile, approximate value of maximum grain size) against M (median) of the grain size distribution on a logarithmic paper. The position of points on a CM diagram depends upon the mode of deposition of sediments, and to distinguish between turbidites, still-water deposits, etc. Deposits of various environments give characteristic pattern. The resulting pattern is shown in (Fig. 7). A distinctive feature of beach sediments is that they are clean. The CM pattern is wide and long. Points are scattered in the coarser part of the pattern and concentrated in the finer part. The action of the waves is reflected in the size distribution of the finer sediments.

There is for each beach a fairly well defined lower limit to the size of the particles which form a large percentage of the samples. However, an appreciable part of the beach sediments consists of particles approaching this limit. The consequence is that the median grain size of a beach pattern has a sharply defined minimum value, and that a number of sample points are concentrated near the minimum median line. This is generally an area of good sorting, where the pattern is close to limit C=M. The CM pattern of the Damapala Sandstone is somewhat comparable to that of beach sediments shown by Passega (see Fig. 8). The pattern is identical with that of the East Florida beach.

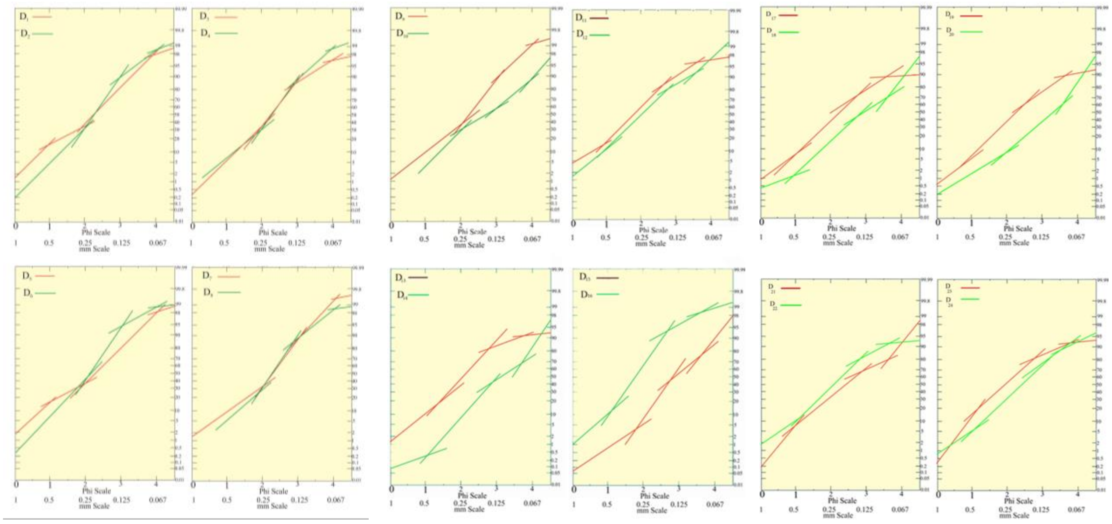

Figure (5). The shape of the grain size curves of the deposits of the Damapala Formation indicating beach environment

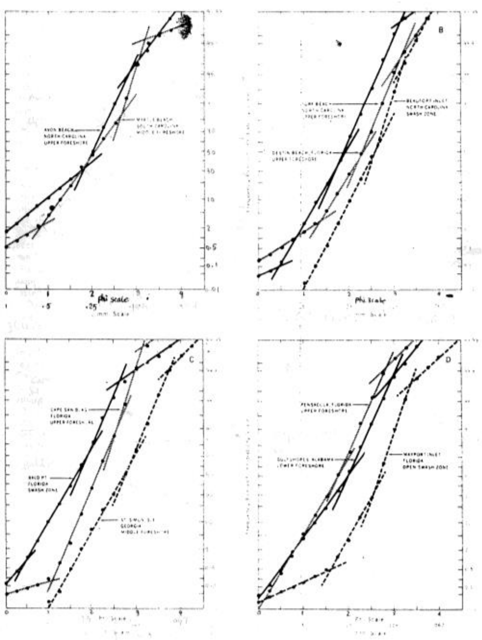

Figure (6). Log-probability grain-size curves of the deposits from Myrtle Beach and Pensacola Beach (After Visher, 1969)

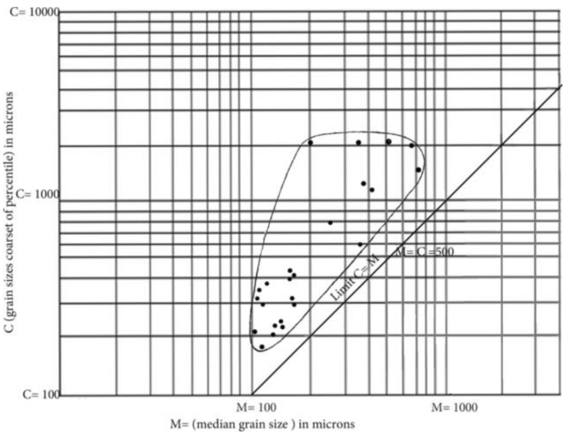

Figure (7). CM pattern of the Damapala Formation of the Powintaungn area

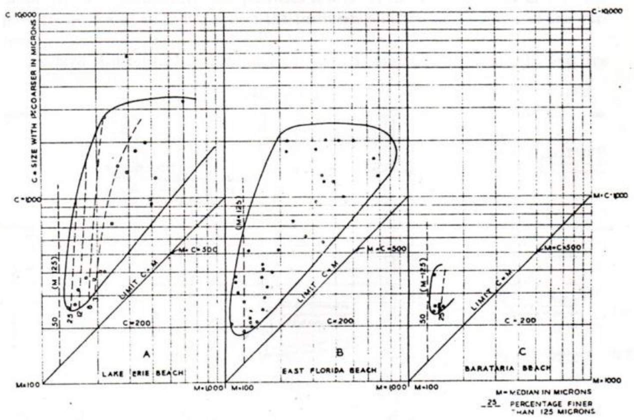

Figure (8). CM pattern of beaches: (A) Lake Erie; (B) East Florida; (C) Barataria, Gulf of Mexico

Summary and Conclusion

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The Damapala Formation is mainly composed of sandstone, siltstone, mudstone and andesitic volcanic rocks.

The characteristics of beaches are from a wide range of physical and provenance conditions. Each size distribution is plotted in identical fashion, and all show three or four populations, with two saltation populations. The break in the saltation populations ranges from about 15% to near 80%. The bed load population when present is poorly sorted, and truncation generally is finer than 2.0 phi; the size range of the saltation population is from 1.0 to 3.5 phi; and the suspension population is well sorted and usually truncated at a size finer than 3.5 phi. The break in the saltation populations ranges from about 15% to near 80%. The similarity of each of the sands of the Damapala Formation is the development of four populations and two saltation populations. From analysis of the size data, the samples of the Damapala Formation could be deposited by beach process. A distinctive feature of beach sediments is that they are clean. The CM pattern is wide and long. Points are scattered in the coarser part of the pattern and concentrated in the finer part. There is for each beach a fairly well defined lower limit to the size of the particles which form a large percentage of the samples. The consequence is that the median grain size of a beach pattern has a sharply defined minimum value, and that a number of sample points are concentrated near the minimum median line. This is generally an area of good sorting, where the pattern is close to limit C=M. The CM pattern of the Damapala Sandstone is identical with that of the East Florida beach.

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