

Depositional Environment of Kalaw Red Beds in the East of Yegyanzin Area, Pindaya Township

Kaung Sithu¹ and Chit Sein²

Abstract

The Kalaw Red Beds are widely distributed in the eastern part of the Yegyanzin Village, Pindaya Township, southern Shan State. It is mainly made up of the matrix supported large conglomerate with subordinate amount of siltstones and sandstones. The present work aims to analyse the depositional environment of the Kalaw Red Beds in the study area focusing on the maximum clast size, primary sedimentary structures and composition of the cements. The pebbles are irregularly arranged and are rare preferred orientation. Graded bedding and flat pebbles are mostly orientated in horizontal. Some fine matrix show pseudo-vesicular structures. The clasts show bimodal with a high degree of variability and poorly sorted. Thus, the depositional environment of Kalaw Red Beds is considered the debris flow deposits of an alluvial fan and the lithofacies ranged from Upper Fan to Middle Fan. Due to the color, sedimentary structures and the absence of marine fossils, it may be deposited in the braided streams of fluvial environment with the fan deposits.

Key words: Kalaw Red Beds, Yegyanzin area, Maximum clast size, Fluvial fan

Introduction

Most of the Paleozoic and Mesozoic rocks units are well exposed in Yegyanzin Village and its environs, Pindaya Township, southern Shan State. Paleozoic units are successively and distinctly exposed in the western part. Mesozoic units especially Kalaw Red Beds, are widely exposed in the eastern part. Many previous workers (Brown & Sondhi, 1933; Reed, 1936; Myint Lwin Thein, 1973; Garson et al., 1976; Bender, 1983; Wolfart et al., 1984, Ma Than Sein, 1994; Chit Sein, 1998; Ohnmar Soe Yin, 2004) studied the geology, stratigraphy and paleontology, however it is very rare in the sedimentological studies of conglomerate beds of Kalaw Red Beds. The aim of the present study is to study the depositional environment of the conglomerates in the Kalaw Red Beds from the east of Yegyanzin area, Pindaya Township, on the basis of clast size analysis.

Location

The study area is located about 30.4 km from north of Aungban and 7 km south of Pindaya Golden Caves, Pindaya Township, southern Shan State (Figure 1) and it is also situated at the southernmost part of the Pindaya Range (20° 55' 18" N and 96° 39' 58" E). The study area lies on the one inch topographic map no. 93 D/9 and it is also demarcated between horizontal grids 29 to 35 and vertical grids 17 to 27. The total areal coverage is 49.86 square kilometers.

Materials and Method

The conglomerates are systematically collected from the Kalaw Red Beds in the eastern part of the Yegyanzin area and the maximum clast size and their ratio in the standard unit area (one square meter) are also carefully observed in the field. The depositional

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environment is focused based on the maximum size clast properties (grain size analysis) with the primary sedimentary structures and the composition of the cementing materials according to the Reineck & Singh, 1980.

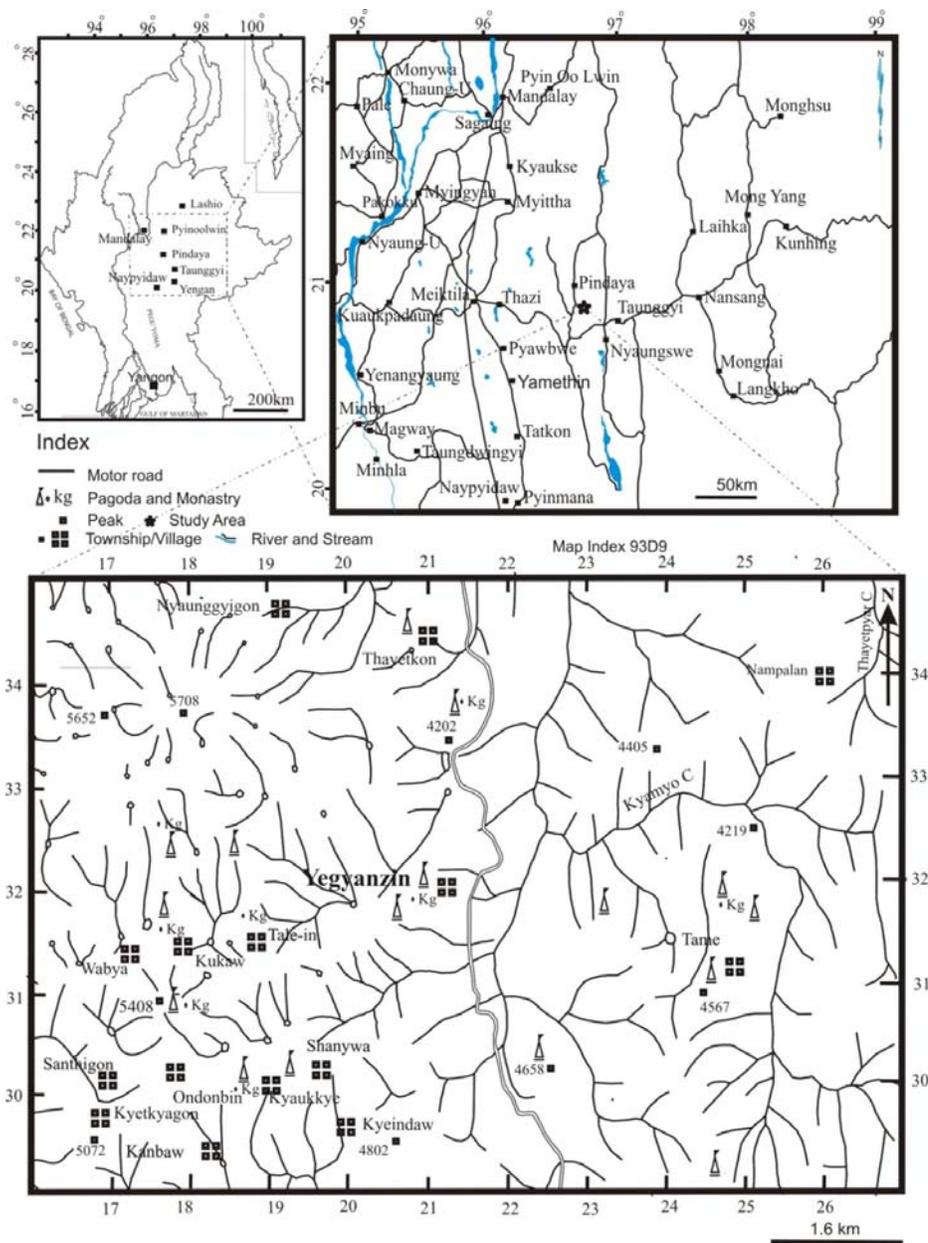


Figure (1) Location map of the study area

Regional Geologic Setting

Pindaya Range is a south plunging anticline, although the northern half of the range is very complex with the overturned and recumbent folds (Myint Lwin Thein, 1973). Two major longitudinal faults are observed in this range. The Pindaya - Kawngpo Fault is in the eastern flank and the Ingyi-Ingaung Fault is in the west of range.

Well exposures of Lower Paleozoic strata are mainly covered with the marine invertebrate fauna in the Pindaya Range (Figure 2). The rock sequence of that range is Precambrian rock units of Chaungmagyi Group through to the Late Jurassic to Early Cretaceous of Kalaw Red Beds, respectively. The study area is situated at the south and southeastern margin of the Pindaya Range. At first, low grade metamorphic rocks of Precambrian age are exposed in the western part of the southern Shan State that is referred as the Chaungmagyi Group which exists as the larger inliers at the northern part of Pindaya range and unconformably overlain by the Cambrian rocks of Molohein Group (Myint Lwin Thein, 1973).

In Cambrian, these rocks are represented by Molohein Group which consists of pink, purple and reddish brown, highly micaceous sandstone and well recrystallized pinkish white or purplish white colour quartzites with subordinate amount of sub greywacke, gritty sandstone, phyllites, dolomite, limestone and conglomerate. They are unconformably overlies on the Chaungmagyi Group with the basal conglomerate, clasts of quartzite. Finely crystalline dolomite, thick bedded, dark bluish grey occurs at the upper horizon. This group was divided into two Formations: Late Cambrian Myet-ye Formation and Early Cambrian Pandung Formation by Myint Lwin Thein (1973). Pandung Formation is the lowest unit of Molohein Group and dominated by whitish, pinkish, purplish and buff color quartzite with subordinate amount of whitish or buff, sub indurated, medium grained sandstones whereas Myet-ye Formation, upper part of this group, is mainly composed of purplish micaceous sandstones and associated with thin bedded or massive quartzite sandstone.

Carbonates and clastics were also deposited with the various sub environmental facies in the marine region in Ordovician age. Pindaya Group is mainly made up of the calcareous shales, slates and thin bands of argillaceous limestone of the southern Shan State. It is divided into four subdivisions, Lokeyyin Formation (Early Ordovician), Wunbye Formation (Middle Ordovician) and Nan-on Formation (Late Ordovician) with Tanshauk Member (Late Ordovician).

The Mibayataung Group (Silurian) is divided into two formations, Linwe Formation and Wabya Formation with Taungmingyi Orthoquartzite.

Linwe Formation contains the pink and grey phacoidally structure limestones, argillaceous limestone, calcareous mudstone and Shale. *Michelinoceros* sp. are very rich as unique features.

Wabya Formation consists of light grey, soft to sub indurated, micaceous or non micaceous shales and silty shales, with minor amount of the black slaty shales, slates, bentonitic and ash beds and coal layers in some locality. Orthoquartzites of the Taungmingyi Member is well sorted, very poorly cemented, fine- to medium-grained massive quartzite.

The Plateau Limestone Group is widely exposed in both flanks of the Pindaya Range. It can be identified into two categories such as Calcitic limestone and Dolomitic limestone. The Calcitic limestone is mainly composed of massive to thick bedded, fine- to coarse-grained, crystalline limestone with corals, fusulinids, and cephalopods shells. The Dolomitic limestone is composed of thick bedded, fine- to coarse-grained, dolomitic limestones with highly jointed (criss-cross joint pattern) or brecciated.

Kalaw Red Beds is well cropped out in the eastern part of the Yegyanzin Village. It is mainly composed of red colour, medium bedded siltstone, yellow to buff colour shale and interbedded sandstone and conglomerate.

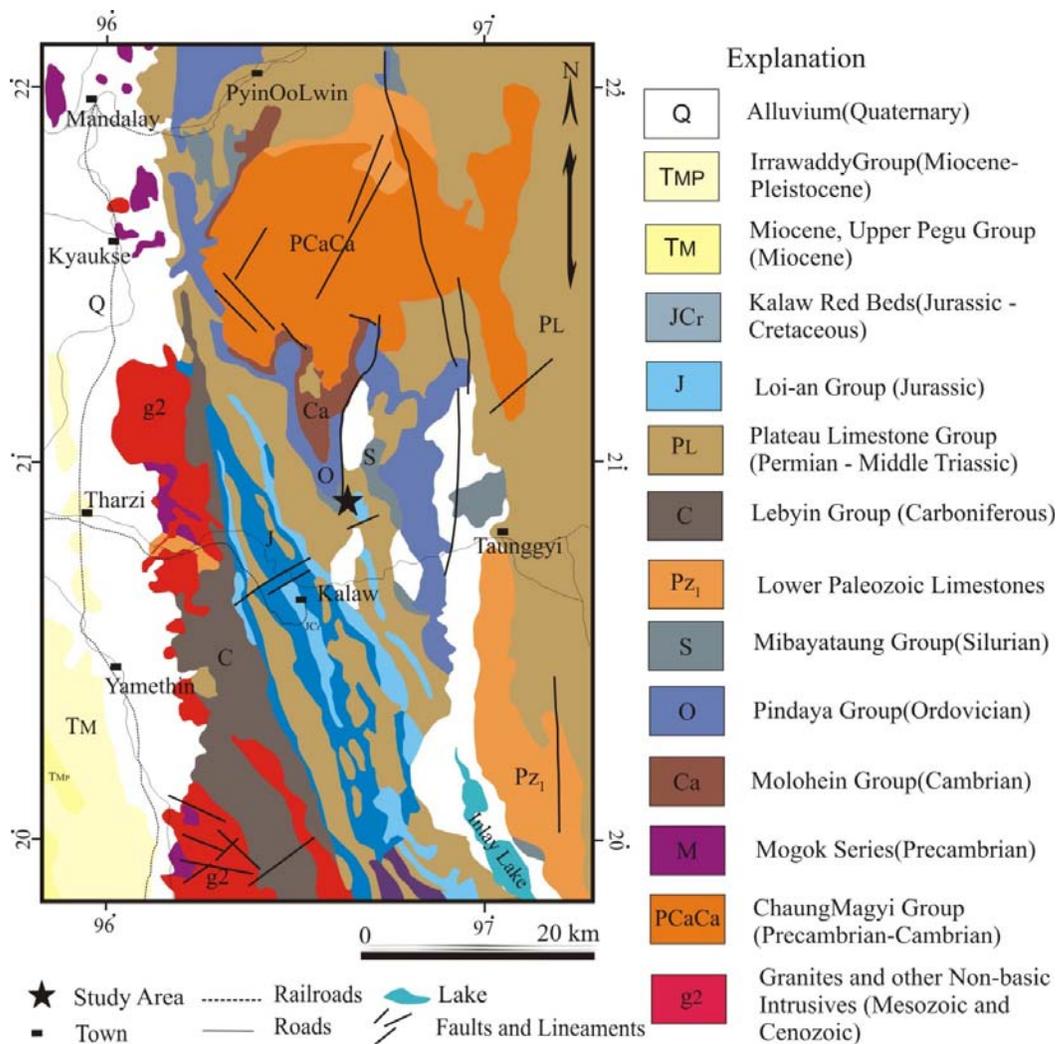


Figure (2) Regional geological map of the study area
 (cited from Geological map of Myanmar, Bender, 1983)

Stratigraphy

The study area is situated at the western margin of the eastern highland which is mainly made up of Paleozoic and Mesozoic rock units (Table 1). Myint Lwin Thein (1973) studied the Lower Paleozoic stratigraphy of the southern Shan State named them as the Pindaya Group for the Ordovician rock sequences and Mibayataung Group for the Silurian rock sequences, respectively.

The Plateau Limestone was first introduced by La Touche (1913). Garson et al. (1976) suggested that the three formations of Plateau Limestone Group from southern Shan State such as Thitsipin Limestone Formation in the lower part, Nwabangyi Dolomite Formation in the middle part and Natteik Limestone Formation at the upper part of the Group, respectively.

The Kalaw Red Beds is mainly composed of large conglomerate with subordinate amount of red sandstone, siltstone and shale. It is unconformably demarcated with the Plateau Limestone Group in the study area.

Table (1) The rock sequence of the study area

| Rock Unit | - | Geological Age |
|-------------------------|--------------|--------------------------|
| Alluvium | - | Quaternary to Recent |
| ~~~~~ | unconformity | ~~~~~ |
| Kalaw Red Beds | - | Jurassic to Cretaceous |
| ~~~~~ | unconformity | ~~~~~ |
| Plateau Limestone Group | - | Carboniferous to Permian |
| ~~~~~ | unconformity | ~~~~~ |
| Devonian Unit | - | Devonian |
| Mibayataung Group | - | Silurian |
| - Taungmingyi Member | - | Late Silurian |
| - Wabya Formation | - | Early to Late Silurian |
| - Linwe Formation | - | Early Silurian |
| Pindaya Group | - | Ordovician |
| - Tanshauk Member | - | Late Ordovician |
| - Nan-on Formation | - | Late Ordovician |
| - Wunbye Formation | - | Middle Ordovician |
| - Lokeyin Formation | - | Early Ordovician |

Kalaw Red Beds

Name derivation

The term “Kalaw Red Beds” was first used by Middlemiss (1900) for the red and purple coloured mixed siliciclastics (conglomerate-sandstone-mudstone) exposed in the vicinity of Kalaw, situated about 15km north of Pindaya Township, southern Shan State.

Distribution

The rocks are widely distributed in the eastern part of the Yegyanzin Village, mainly exposed the whole part of the Satkyar Taung, Tame Village and east of Thayetgon Village (Figure 3).

Lithology

The Red Beds of Kalaw Formation mainly exposed at the eastern part of the Yegyanzin area. These are largely matrix supported conglomerate with subordinate amount of siltstone and sandstone. Most of the beds are poorly sorted and the main portion of the rock composed of dolomite clasts (Figures 4-7). Sources of the composing materials are mainly originated from the west. According to the measure section, the sediments are mostly bimodal with a high degree of variability, poorly sorted showing matrix-supported clasts and

mostly fining upward sequence. Red color, medium bedded siltstone, white color sandstone are mainly deposited at the Kyarmyo Chaung, near the Tame Village.

Stratigraphic relationship

This unit is unconformable overlies the rocks of Plateau Limestone Group at the eastern part of the area.

Faunal content

Fossils are not traced.

Age and correlation

The unit is Jurassic to Cretaceous in age with the regional stratigraphic reference and correlated with the Hsibaw Red Beds of northern Shan State.

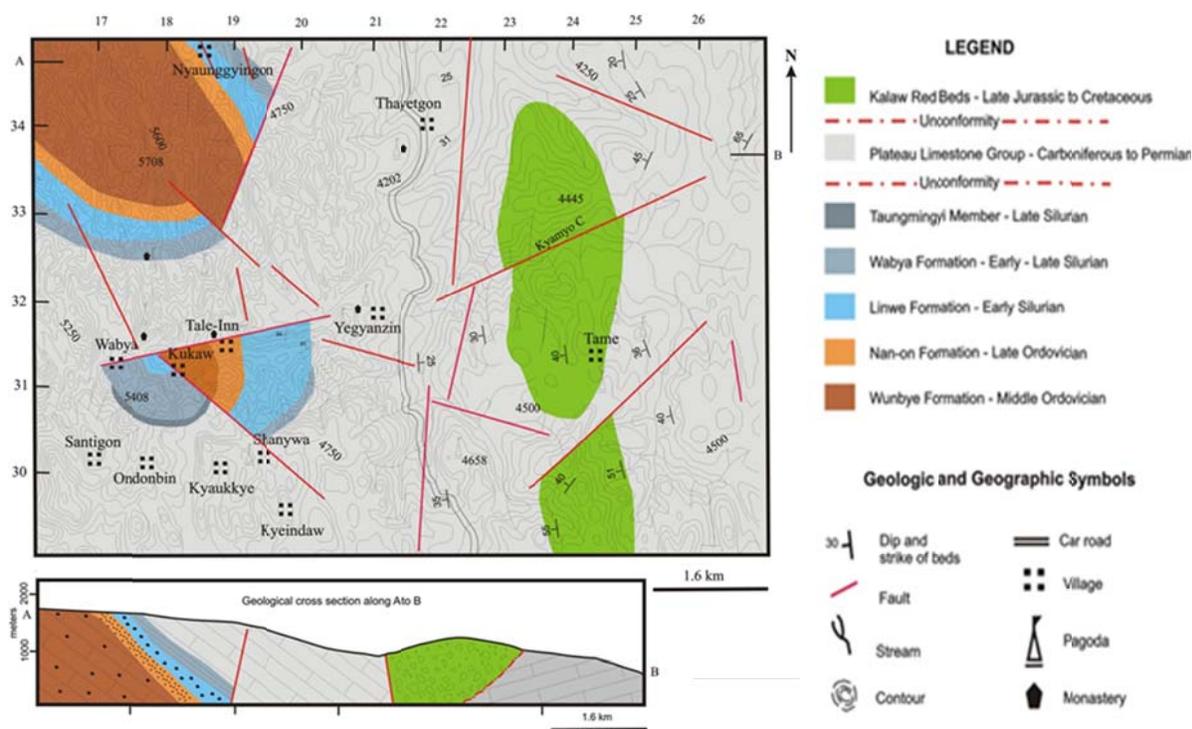


Figure (3) Geological map of the Yegyanzin area (modified after Ma Than Sein, 1994)



Figure (4) Thick bedded to massive angular conglomerate with silt layer near the Satkyar Taung Monastery (Loc: 20° 53' 12.3"N; 96° 40' 43.9"E, Photo looking N)



Figure (5) Showing the orientation of pebble from the angular conglomerate, near the Satkyar Taung (Loc: 20° 53' 12.2"N; 96° 40' 43.1"E, Photo looking NW)



Figure (6) Poorly sorted angular conglomerate with silt patches, southeast of Thayetgone Village (Loc: 20° 53' 40.2"N; 96° 39' 21.1"E, Photo looking SW)



Figure (7) Showing the fining upward sequences of angular conglomerate, near the Satkya Taung, eastern part of Yeagyanzin Village (Loc: 20° 53' 15.2"N; 96° 40' 50.1"E, Photo looking SW 210°)

Depositional Environment of the Kalaw Red Beds

The Kalaw Red Beds are widely distributed in the eastern part of the Yegyanzin Township. They range in age from Late Jurassic to Cretaceous. These Red Beds from the study area are largely matrix supported conglomerate with subordinate amount of siltstone and sandstone. Most of the beds are poorly sorted and the main portion of the rock composed of dolomite clasts. Sources of the composing materials are mainly originated from the west. These materials probably originated under moist and warm conditions that transportation from the origin places to the depositional site was accomplished mainly by streams. These streams carried the red materials without important color changes. The colors of Red Beds are due to the hematite or some other form of ferric oxide (Twenhofel, 1926).

The pebbles are irregularly arranged and are rare preferred orientation. Thus, the deposition is very rapid. Graded bedding and flat pebbles are mostly orientated in horizontal. Some fine matrix show pseudo-vesicular structure due to the entrapment of air. According to the measured section, the sediments are mostly bimodal with a high degree of variability, poorly sorted showing matrix-supported clasts and mostly fining upward sequence. Maximum clast size and their ratio are shown in Table (2) and Figures (8 & 9) and variation of the clast sizes is shown in Figure (10).

On the basis of these facts, the depositional part of Kalaw Red Beds is considered the debris flow deposits of an alluvial fan and their dominated matrix-supported deposits. Some clast-supported deposits show that the lithofacies of their distribution is probably ranged from Upper Fan to Middle Fan near the Satkyar Taung Monastery and in east of Thayetgone Village. These alluvial fan sediments are deposited in extremely oxidizing conditions (Reineck & Singh, 1980). These deposits also occurred as fault breccia; it is located near the fault zone and observed near the Thayetgone Village.

Due to the red color, sedimentary structures and the absence of marine fossils, the depositional environment cannot be normal, shallow marine waters. Ripple marks, desiccation cracks and other sedimentary structures such as swill-fill structure are poorly preserved near the Satkyar Taung and Kyarmyo Chaung. Normal graded bedding and reverse graded bedding are also observed. But, most of the beds are fining upward sequence. The above features are strongly indicated that the depositional environment of Kalaw Red Beds in this area can be defined as braided streams of fluvial environment with the fan deposits.

Table (2) Presentation of clast data

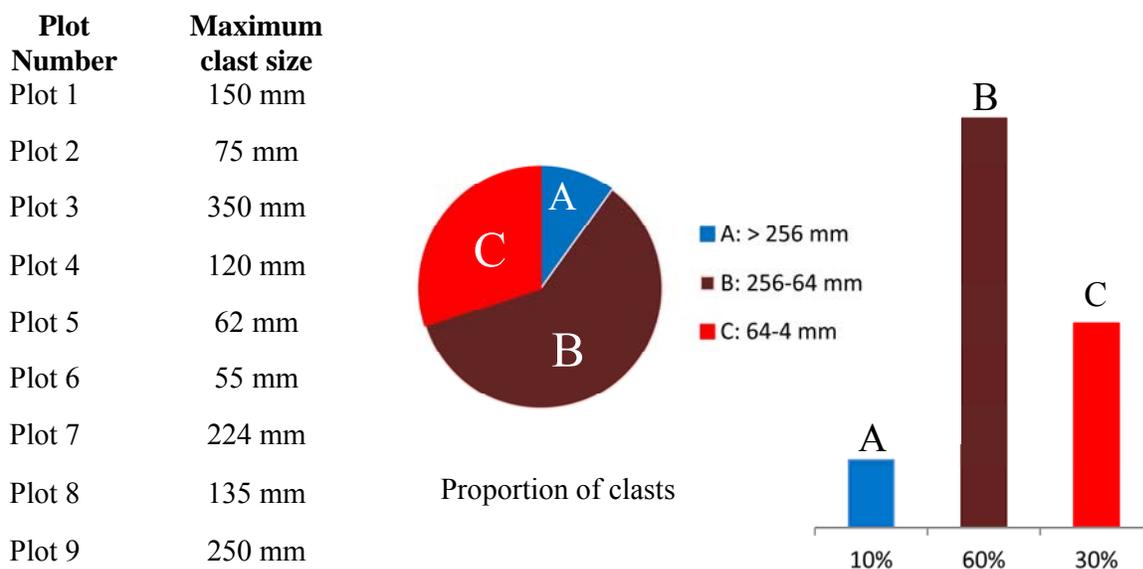


Figure (8) Proportion of clast sizes

Conclusion

Most of the Paleozoic and Mesozoic rocks units are well exposed in Yegyanzin Village and its environs, Pindaya Township, southern Shan State. The Kalaw Red Beds are

widely distributed in the eastern part of the Yegyanzin area. The depositional environment of the Kalaw Red Beds in the eastern part of the Yegyanzin area are discussed in the present paper on the basis of maximum clast size analysis, primary sedimentary structures and composition of the cements.

st size

%

Figure (9) Showing the measured section of Kalaw Red Beds and the presentation of clast data

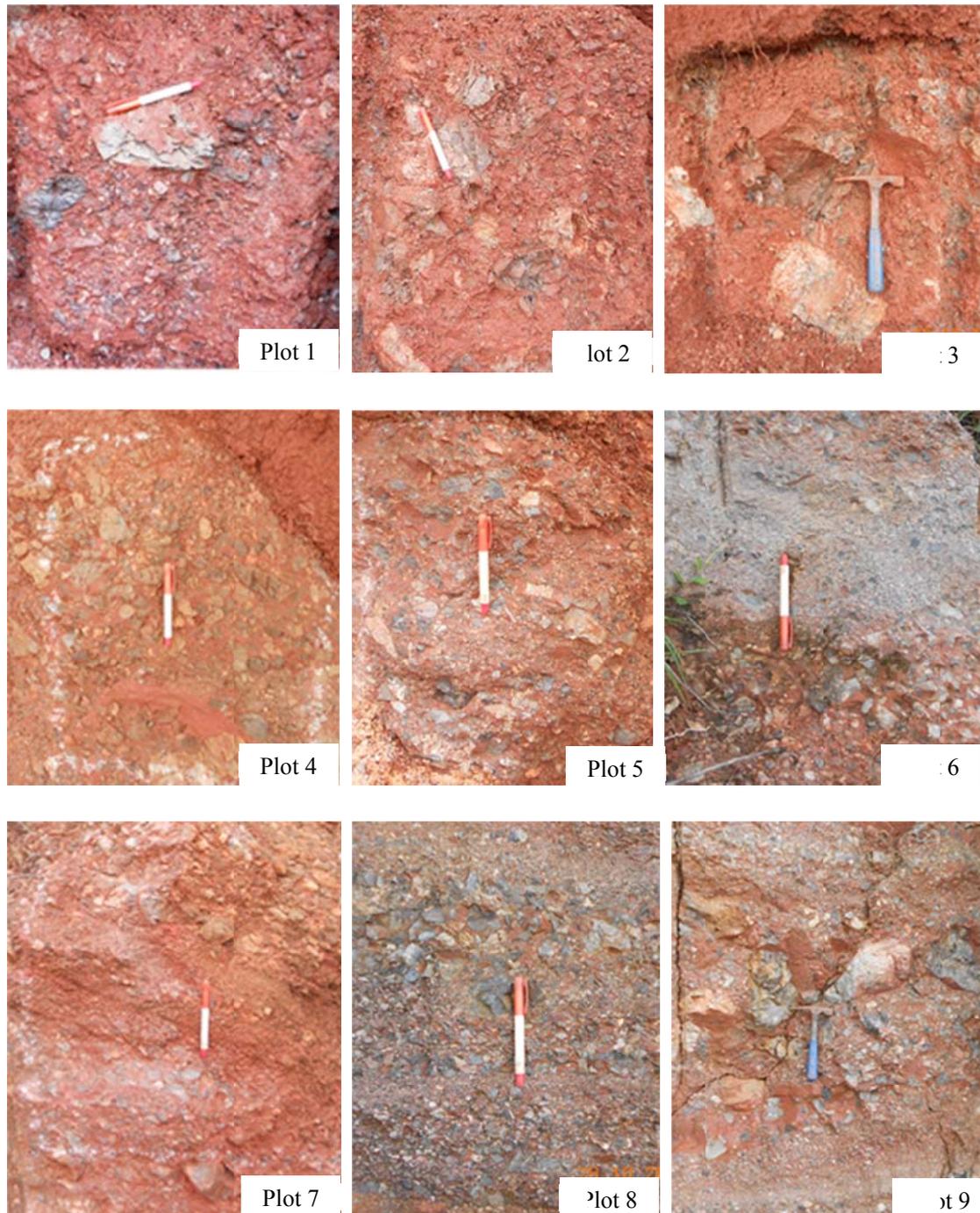


Figure (10) Showing the plot number (stratigraphically) and variation of clast sizes

The Kalaw Red Beds are mainly made up of the matrix supported conglomerate with subordinate amount of siltstone and sandstone. The pebbles are irregularly arranged and are rare preferred orientation. Graded bedding and flat pebbles are mostly orientated in horizontal. Some fine matrix show pseudo-vesicular structure due to the entrapment of air. The sediments are mostly bimodal with a high degree of variability, poorly sorted.

On the basis of these facts, the depositional part of Kalaw Red Beds is considered the debris flow deposits of an alluvial fan and their dominated matrix-supported deposits. Some clast-supported deposits indicate the lithofacies ranged from Upper Fan to Middle Fan. Due to the red color, sedimentary structures and the absence of marine fossils, the depositional environment of the Kalaw Red Beds may be determined as braided streams of fluvial environment with the fan deposits.

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