

Geology of the Lebyin-Yebu Area, Thazi and Kalaw Townships

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Abstract

The study area is situated about 40 miles SE of Thazi, Mandalay Regions. It is situated between North Latitudes 96° 23' to 96° 29' and East Longitudes 20° 42' and covering parts of one inch topographic map 93 D/6. At the eastern part of the area, it covers with thick vegetation and forested. The highest point is 3950 ft above sea level. The central part of area is an alluvial plain. At the western part of the area, the most found sandstone and mudstone. Topography are given smooth rolling thick vegetation and fairly forested. The highest point of Nanpalaung Taung is 2220 ft. It is generally dendritic drainage pattern. The rock sequence of the study area is subdivided into three groups; these older to younger, are (1) Lebyin Group, (2) Thitsipin Limestone Formation and (3) Kalaw Red Beds Formation. The Lebyin Group is a succession of greywacke, indurated mudstone, pebbly, mudstone, tuffaceous sandstone and conglomerate. These rocks can be subdivided into four lithostratigraphic units of formation rank which are only informally named. These are, from older to younger; L₁ Indurated Mudstone and Greywacke; L₂ Pebbly Mudstone and Indurated Mudstone; L₃ Indurated Mudstone and Greywacke; L₄ conglomerate and Tuffaceous Sandstone. The faunal evidence indicates that the Lebyin Group is lower carboniferous in age. The Thitsipin Limestone into three main facies; a massive limestone facies with abundant big brachiopods; a massive cherty limestone facies; and a well-bedded calcarenite facies. Kalaw Red Beds unit contains conglomerates, siltstone and sandstone. Lithic fragments are usually common in these rocks. In the study area, they are trending roughly N-S with fair high dips. The folded Lebyin Group are unconformably overlain by the general dipping rocks of the Kalaw Red Beds. A major longitudinal fault that is close to the Myittha Chaung has been interpreted as an east dipping thrust.

Keywords: Lebyin Group, Thitsipin Limestone Formation, Kalaw Red Bed Formation

Introduction

Location and Size

The study area is situated about 40 miles SE of Thazi, Mandalay Division. It is situated between North Latitudes 96° 23' to 96° 29' and East longitudes 20° 39' to 20° 42' and covering parts of one inch topographic map 93 D/6. The study area 5 miles long in an east-west direction and 5 miles wide in a north-south direction, covers approximately 25 square miles. The study area is connected with from Meiktila to Thazi by car and from Thazi to Lebyin by train.

Purpose of Investigation

The main purposes of the present work are:

1. To prepare a fairly detailed geological map of the study area
2. To establish the stratigraphic units of the area and to correlate them with those of other well known area
3. To interpret the depositional environments of the units
4. To study the petrology of the rock units
5. To analyse the geological structure present
6. To investigate the economic possibilities of the area

Topographic features and Drainage pattern

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This study area is subdivided into three parts based on their topographic character. At the eastern part of the area, it covers with thick vegetation and forested. Few parts of the plateau can be described as really rugged, and the mountains rise gently from the surface; the highest point is 3950 ft above sea level. Sometimes it is noticeable that the ascent to the plateau is built up of a series of steps. It has been let down by a series of parallel faults running in a north-south direction.

The central part of the area is an alluvial plain. But the southeastern part of the area forms a low lying terrain with the main height of about 3410 feet above sea level. It is underlain by siltstone and conglomerate of the kalaw Red Beds Formation. The soil cover is generally thick, particularly on the low-land area. Land use is made on flat low lands where seasonal plants and crops are being grown.

At the western part of the area, the most found sandstone and mudstone. Topography is given smooth rolling thick vegetation and fairly forested. The highest point of Nanpalaung Taung is 2220 ft.

At the eastern part of the area, the main streams are Aloung chaung, Law chaung, Bwet chaung and Yega chaung. Law chaung and Aloung chaung are parallel flow from east to west. Bwet chaung and Yega chaung are parallel flow from south to north. They are flowing into Yebu chaung. In the central and western part of the area, the main stream is Myittha chaung. Polokkyi and polokkale chaung are parallel flowing from west to east in the study area. Nanpalaung chaung and Gwave chaung are flowing from west to east. These streams are flowing into Myittha chaung. It is generally dendritic drainage pattern.

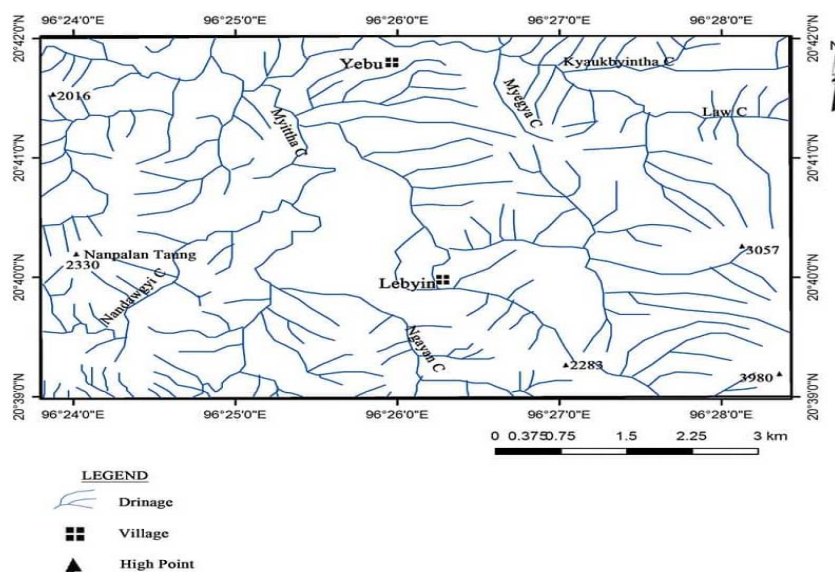


Figure. Drainage Pattern of the Study area

Previous work

As early as 1942, A.B Dutt first mapped a wide region including present area on a reconnaissance level. He correlated the metasedimentary rock of this area with those of the loi-an series (Jurassic) on the trends and lithology.

Aung Myint Thein and Myo Min (1973) mapped the eastern part of the pyawbwe, Yamethin, Tatkon Townships. Ko Ko and some Han made a general study of Paungdaw-kogwe chaung areas during (1973).

Shwe Win (1974) mapped the lebyin-shweminbone area and first men-tioned the carboniferous age for the so called Lebyin Group.

A regional geological map of the lebyin area is also prepared by National stratigraphic Committe (1977). They subdivided into the Lebyin Group into four formations from lower to upper;

1. Kogwe formation
2. Polokkyi formation
3. Modi formation
4. Paukkwa formation

Tun Soe (1985) mapped the Lebyin Group can be subdivided into at least four stratigraphic units of formation rank. They are informally names as following;

- L₄ - Conglomerate and Tuffaceous sandstone
- L₃ - Indurated mudstone and Greywacke
- L₂ - Pebbly mudstone and Indurated mudstone
- L₁- Indurated mudstone and Greywac

Regional Geologic Setting

Generally, the study area is geologically complicated area lying the limestone in the east and elastic sediment rocks in the central and western part of the area. The Lebyin Group (carboniferous) exposed NNW-SSE trending belt extending from the Pyinnyaung area to the east of Pyinmana. The Lebyin Group is extensively exposed in the central and eastern part of the area. They are folded into three anticlines and two synclines which trend roughly north-south.

Thitsipin limestone formation is well exposed at the eastern part of the area; Bwet cheung, Theyet cheung, kyaukkhat chafing and Zinyaw cheung. This unit uncomfortably overlies the Lebyin Group.

Interbedded reddish conglomerates, siltstones and sandstones of the kalaw Red Beds are exposed along the Myittha chaung and locally in the eastern part. This unit uncomfortably overlies the Thitsipin limestone Formation.

Methods of study

A reconnaissance study on the geology of the area was made and detailed investigation and mapping were carried out in November, 2004. Final field checking was completed in January, 2005.

Aerial photographs and one-inch topographic maps 93 D/6 was used in order to construct a base map. With the aid of photogeological interpretation, the lithologic boundaries, structural trends, and possible fault traces and joints were drawn onto the base map of four inches to a mile.

Traverses parallel to and across the regional structures were made. The geological data such as dips and strikes, joints and faults of each unit were measured and recorded. Then these data were plotted onto the base map. Representative rock samples and fossils were collected and carefully marked. Stratigraphic measurements were done in Ngayan chaung, kyaukkhat chaung, Polokkyi chaung and along the Lebyin-Yebu rail road.

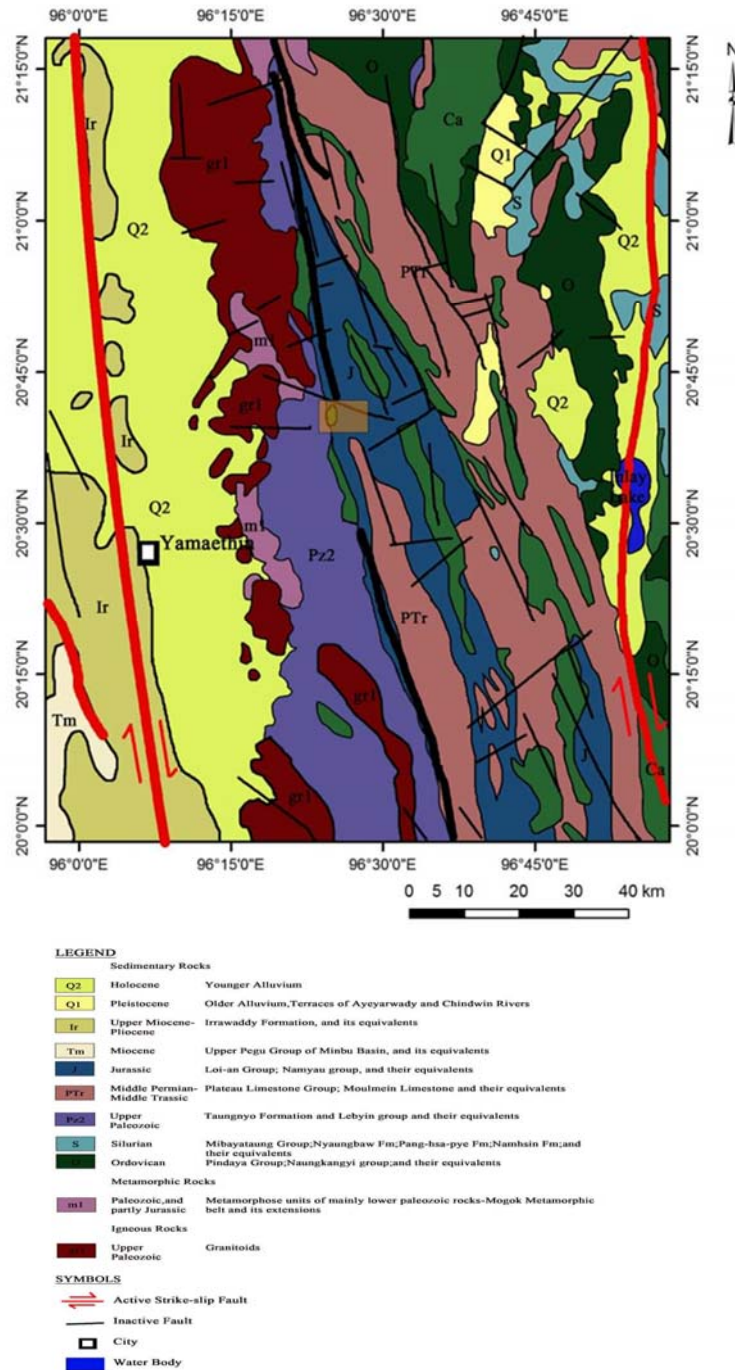


Figure. Regional geological setting of research area

Stratigraphy and Lithology

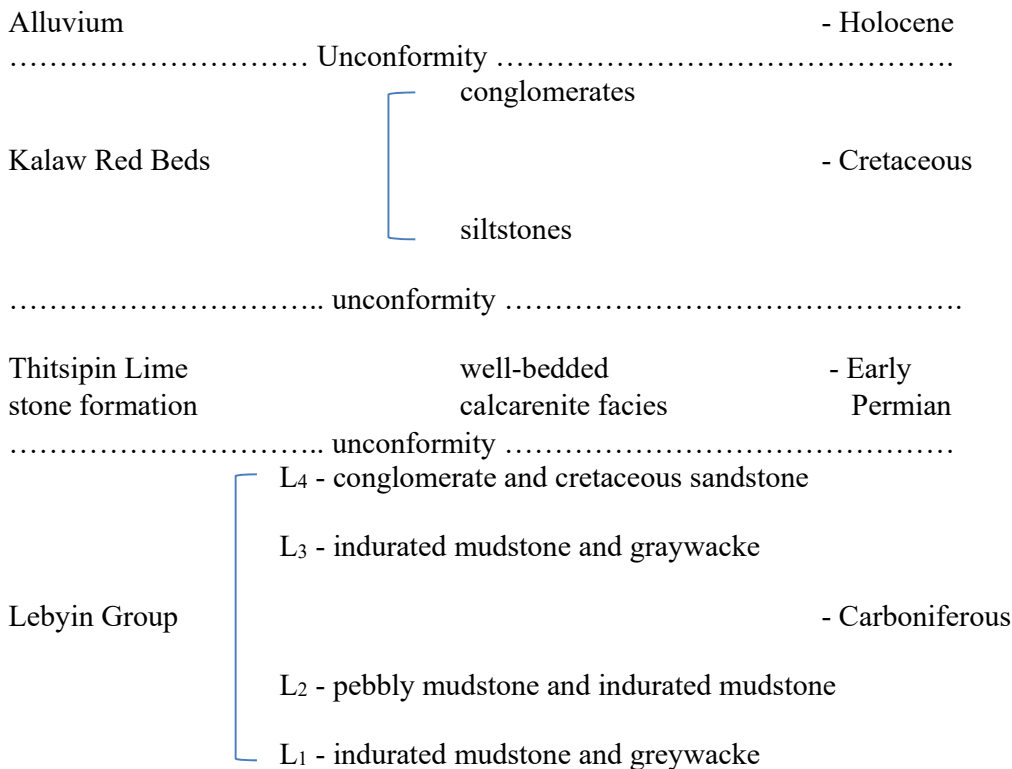
Stratigraphic Succession

In the study area, the lithostratigraphic classification shown in table is based on; (1) distinctive pathological characters of the various units; (2) some stratigraphic measurements (3) fossils from the lebyin units. The four units of the lobyin Group are of formation rank. However, formal names are not introduced here as the stratigraphic correlation and coordination with the adjoining northern and southern area are still needed.

The rock sequence of the study area is subdivided into three groups; these older to younger, are (1) Lebyin Group

- (2) Thitsipin Limestone Formation
- (3) Kalaw Red Beds Formation

The stratigraphic succession of the Lebyin-Yebu Area



Lebyin Group

The Lebyin Group consists of elastic meta-sediments of unknown thickness and can be divided into four formations. (Burmese National Committee, 1977). The elastic metasediments are composed of conglomerate, quartzite, slate and pebbly mudstone. Lebyin Group can be subdivided into four formations.

- (1) Kogwe Formation
- (2) Polokkyi Formation
- (3) Modi Formation

(4) Paukkwa Formation (lower to upper)

Tun Soe (1985) mapped the Lebyin Group can be subdivided into at least four stratigraphic units of formation rank. They are informally names following;

I₄ -Conglomerate and cretaceous sandstone

I₃-Indurated mudstone and graywacke

I₂ -Pebbly mudstone and indurated mudstone

I₁ -Indurated mudstone and graywacke

In this study area, all these units are partly well exposed. However, because of the highly folded and faulted nature of the section, it has not been possible to make accurate measurements of the thickness.

Age of Lebyin Group

The found discovered during the present indicate that the Lebyin Group is of Lower Carboniferous age. The fauna and the respective age are as follows:

Siltstone of L₃ unit

Spirifer (carboniferous)

L₁-Unit Indurated Mudstone and Greywacke

This unit is made up largely of very low grade metamorphic rocks such as quartzite, metagreywacke, slate and metamorphosed indurated mudstone.

Exposure: Well exposed section of L₁ unit can be seen along polokkyi chaung.

Lithology: The unit consists of very thick bedded indurated mudstone and minor amounts of greywacke. The indurated mudstone is thick bedded to massive, often laminated, and dark bluish grey to darkgrey.

Greywacke is medium to thick bedded, fine to coarse grained and light green to dark grey. In some horizons, the graywacke contains a large amount of quartz and it shows a well developed granular texture. The upper boundary is easily defined by the first appearance of pebbly mudstone.

L₂ Unit Pebbly Mudstone and Indurated Mudstone

This unit is made up largely of pebbly mudstone and indurated mudstone with subordinate amount of quartz Wacke. The lower and upper boundaries of L₂ unit are readily defined by the appearance of pebbly mudstone, respectively.

Exposure: Good exposures can be seen in Nandawgyi chaung. Its northern continuation is not well exposed in the Polokkyi chaung.

Lithology: This unit is composed of the attention of thick subunits of pebbly mudstone and indurated mudstone with lesser greywacke.

Pebbly mudstone often contains lens or irregular bands of fine-grained sandstone. At such places, pebbly mudstone generally is interbedded with coarse-grained graded sandstone.

L₃ Unit-Indurated Mudstone and Greywacke

Exposure: This unit is found in Nga-Yan chaung and along the lebyin rail road. This unit is widely distributed in the whole area.

Lithology: This unit is composed of interbedded mudstone and sandstone. Mud stone is the dominant rock type. Small scale cross-lamination and load-cast are common in this unit.

Mudstone is mostly in dark bluish-grey when fresh, but weathered to buff colour. Carbonaceous material occasionally occurs in these mudstone.

Along the Nga-yan chaung and also along the east tributaries of Myittha chaung, compact quartzite sandstone have been classified and form as very hard. Dark bluish grey to light grey, medium-bedded limestone is well developed in the upper part of this unit. At Kalama chaung, this unit is overlain by the red conglomerate and siltstones of the Kalaw Red Beds. However, the lower most conglomerate layer of L₄ unit is found conglomerate overlying L₃ unit in Kogwe chaung and Nandawgyi chaung.

L₄ Unit-Conglomerate and Tuffaceous Sandstone

Exposure: Good exposures of the L₄ unit are in the Kogwe chaung sections. Several outcrops of cretaceous sandstone and conglomerate have been recorded in the western bank of the Myittha chaung. This unit occurs along the major fracture zone of the area.

Lithology- The unit comprise a attempting sequence of cretaceous sandstone, conglomerate and a few lenses of limestone. Tuffaceous sandstone is thin to medium-bedded, light brown to grey in colour. Normal graded bedding and cross-bedding occur in this sandstone.

Thitsipin Limestone Formation

General: This unit was firstly named by Garson, et al, 1976, after Thitsipin village, north of Ye-ngan. The formation is well-exposed at the type area and the area to the east and SE of linwe villages. Garson et al. (1976) divided the Thitsipin limestone into three main facies;

a-a massive limestone facies with abundant big brachiopods.

b-a massive cherty limestone facies.

c-a well bedded calcarenite facies.

Exposure: This unit (facies-c) is well exposed at the eastern part of the area: Bwet chaung, Theyet chaung, kyaukkhat chaung and Zinyaw chaung.

Lithology: Medium-bedded, dark grey to bluish grey limestone can be seen at kyaukkhat chaung. A few beds show cross bedded and calcite veins (0.1-3 cm) can be seen in kyaukkhat chaung. In some localities, the light grey, compact, fine-grained

limestone contains orientation of the chert lenses and pods. Where the formation has been dolomitized, the rocks are pale grey obscured by intense embroccation which is interpreted to be a consequence of the dolomitization by Garson et.al (1976).

Fossils and Age

A number of surliness were discovered. The smaller foraminifera and surliness are also late Permian in age.



Figure. Medium-bedded, light grey, tuffaceous sandstone in the western bank of Myittha Chaung

Kalaw Red Bed Formation

Introduction

A sequence of alternating subunits of thick-bedded, reddish conglomerate and siltstone is regarded as equivalent to the kalaw Red Beds (cretaceous). There is no doubt that an angular unconformity exists between the Lebyin Group and the overlying Kalaw Red Beds, and this relation can be readily recognisable in the field, e.g. in the stream sections of Kogwe chaung, Myittha chaung and Kalama chaung.

Exposure: This unit is well exposed along the Myittha Chaung. Myittha chaung flows generally parallel to the trend of this units. The exposed sections are also limited along the tributaries. Also there is thick soil cover on this unit.

Lithology: This unit is mainly composed of reddish brown to pinkish, medium to thick-bedded conglomerates and reddish, thin to thick-bedded siltstone with minor amount of sandstone.



Figure. Medium-bedded bluish grey limestone with calcite veins

Conglomerate, the dominant rock type is fairly stratified and commonly interbedded with siltstone, limestone, quartzite, Phyllites, slate and igneous rocks. These rounded gravels are embedded in a matrix of silt or fine-grained sand.

Reddish, fairly compact siltstone occurs as medium to thick-bedded, parallel and cross- stratified layers. Fine to medium-grained sandstone also occurs in several horizons. It varies from thin-bedded to thick-bedded, but thickness of over ten feet is rare.

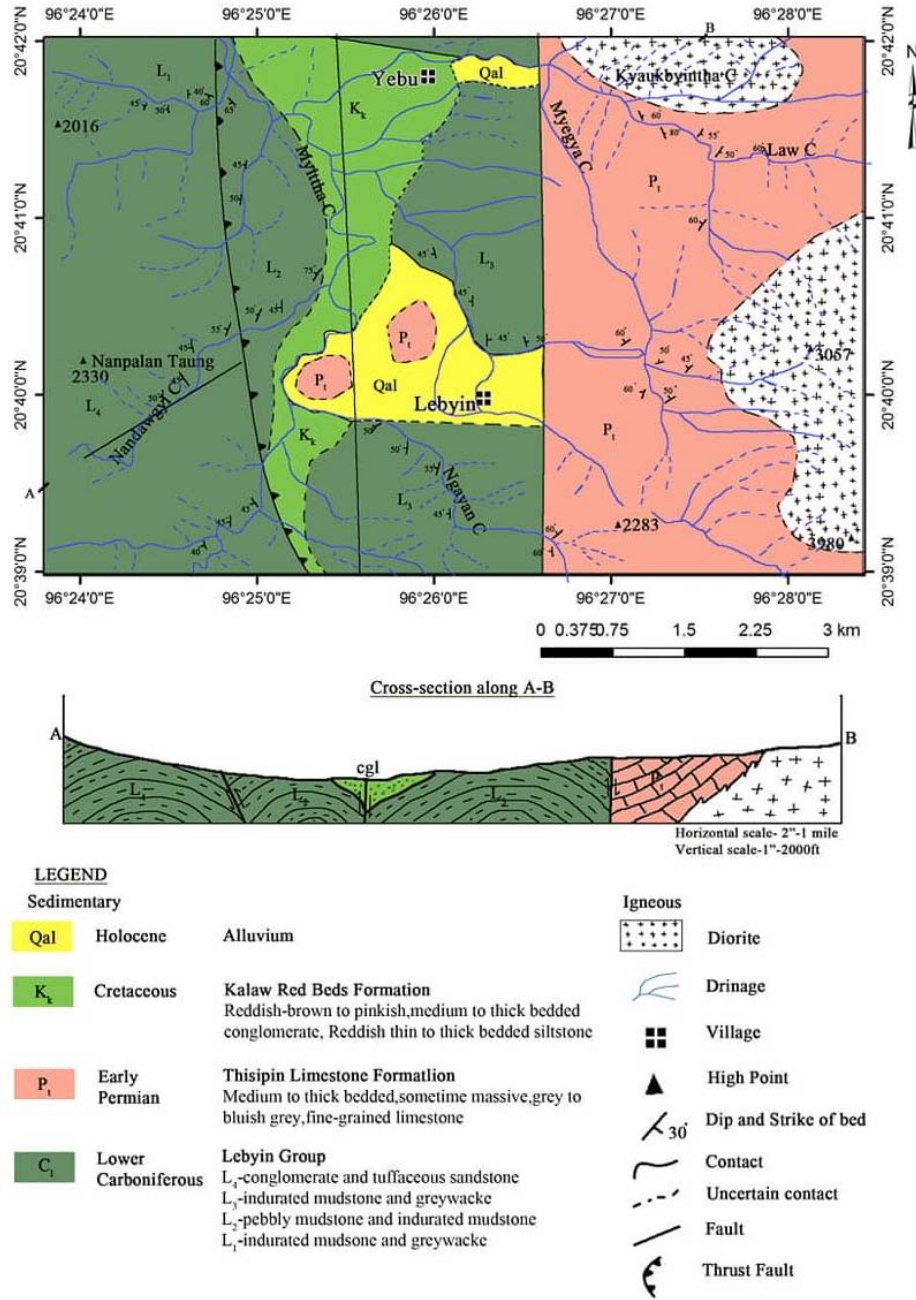


Figure. Geological map of the study area

Geological Structures

Regional Geological Structure

In the study area, they are trending roughly N-S with fair high dips. The folded Lebyin Group are unconformable overlain by the general dipping rocks of the Kalaw Red Beds. A major longitudinal fault that is close to the Myittha chaung has been interpreted as an east dipping thrust.

Folds

Major set of folds is also noted in L₁ unit. A syncline and an adjacent anticline occur in the north of Kogwe chaung. Their axial traces generally are in the N-S direction. The eastern limb of the eastern anticline is partly covered by the upthrust block of L₄ unit.

The western major anticline occur in L₃ unit. Its axial trace lies along the Kyaukmetaung at the adjoining area. It may be a south-plunging western limb and 35°-50° in the eastern limb.

Fault

The three fault sets recognized in the study area are:

1. N-S to NNW-SSE trending longitudinal faults
2. WNW-ESE trending cross fault
3. ENE-WSW trending cross fault

These distinct faults are briefly mentioned below.

N-S to NNW-SSE Trending longitudinal faults

They occur mainly in the central part of the area, especially along the Myittha Chaung.

WNW-ESE Trending Cross Faults

This fault, occurring in the north of yebu village has displaced L₂, L₄ units and the Kalaw Red Beds.

ENE-IVSW Trending Cross Faults

This fault occurs along the lower part of Kogwe Chaung where the stream suddenly changes in direction apparently due to the appearance of this fault.

Joint

The joint strike maximum in the metamorphics and Lebyin rocks are quite different. This difference in two rock groups probably suggests their different deformational histories. The difference in the pattern of both the maximum and the conjugate joint sets lends support to the recognition of two separate groups.

The conjugate joint sets in the metamorphics are NE-SW and nearly E W; those in the Lebyin rocks are ENE-WSW and WNW-ESE. From these conjugate joint sets, it may be interpreted that the principal force in the deformation of the meta- morphic rocks came from ENE and WSW, whereas that of the Lebyin Group came from nearly E and W.

Economic Geology

Introduction

There are two mineralization zones in the study area.

- 1 Gold mineralization in the skarn rocks (contact between diorite and limestone) in the eastern part of the area.
- 2 Stibnite mineralization zone in the quartzites and greywacke of L₃ unit in the southern part of the area.

It can be seen that the formation of these two zones were apparently controlled by the stratigraphy and lithology of the area.

Metalliferous Resources

Two are deposits occurred in the area.

1. Gold deposits
2. Stibnite deposits at Lebyin

Gold deposits

They occurred as primary and secondary gold deposits in the area. Primary gold deposits which is now being worked as a medium- sized mine is located at Zin Yaw Taung. This gold deposits occurs in the skarn rocks (near the diorite dyke) The occurrence of primary gold deposit seems to suggest a hydrothermal mode of origin.

The occurrence of placer gold deposits occurred along kyaukkhat Chaung, Bwet chaung and Kogwe chaung. The source of this gold is likely to be the diorite intrusion of Zin Yaw Taung Placer gold is also found in traces in the kogwe chaung.

Stibnite Deposits at Lebyin

The antimony deposit which is now being worked as a medium-sized mine is located along the Nga-yan Chaung, about a mile south of Lebyin village. Stibnite occurs as veins and veinlets along N-S trending fractures in the classified quartzite and greywacke of L₃ unit. The occurrence of stibnite only in the classified zones seems to suggest a hydrothermal mode of origin for this stibnite deposit. The stibnite content is said to be about 51% with a minor amount of silver (Maun Thein, 1982), the ore reserve for this deposit has not been estimated yet.

Non-metalliferous Resources

Quartzite and diorite of this area can be used as construction and rail- road materials.



Figure. Primary gold deposits in the skarn rocks at zinyaw Taung.

The study area is situated about 40 miles SE of Thazi. It is located between North latitude from 96° 36' to 96° 29' and East longitude from 20° 39' to 20° 42' in one inch topographic map 93 D/6. It covers approximately 25 square miles in area.

The study area is sub-divided into parts based on their topographic character. In the eastern part of the area, it is rough topography, thick vegetation and forested. In the western part of the area, it is rolling topography, fairly thick vegetation and forested. In the central part of the area, it is low lying plain. It covers vegetation and cultivation due to thick soil. The study area is generally dendritic drainage pattern.

The rock sequence of the study area is subdivided into three groups; these older to younger, are (1) Lebyin Group (2) Thitsipin limestone formation (3) Kalaw Red Bed formation. Lebyin Group can be subdivided into at least four stratigraphic units of formation rank. They are informally names following; L₄ conglomerate and tuffaceous sandstone, L₃ - indurated mudstone and greywacke, L₂ - pebbly mudstone and indurated millstone and L₁ - indurated mudstone and greywacke.

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