A Study on the Geology and Petrography of Lead Mineralization in Mogyo Taung and Peikchin Ganaing Taung areas, Ywangan Township, Taunggyi District, Shan State (South)

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Abstract

The study areas, Mogyo Taung and Peikchin Ganaing Taung Areas, lie within the Pindaya Anticline in Ywanagn Township, Taunggyi District, Shan State (south). It is located about 25 kilometers northeast of Ywangan. It covers about 64 square kilometers in Universal Traverse Mercator map sheet No. 2196 /11-12. It is also located between latitude 21°00´ - 21°30´ and longitude 96°15´ - 96°45´. The physiography of the study area is mountainous, and the Mogyo Taung range is trending NNW- SSE. The highest part of the study area is the peak of the Ngwetaunggyi Taung range (1714 metres). Generally, the Pindaya Range is a south-plunging anticlinal fold, but the northern half of the range is very complex, having overturned and recumbent folds and systems of faults in diagonal directions. Pindaya-Kaungpo fault, nearly parallel to the major fold axis of the Pindaya Anticline. The Karani Fault and the Ingyi-Ingaung Fault are trending nearly N-S. Major rock units exposed in the study area and its surrounding environs overlying the Precambrian basement are the Molohein Group (Cambrian), Pindaya Group (Ordovician), Mibayataung Group (Silurian), and Plateau Limestone Group (Early Permian - Middle Triassic). The rocks of the Mibayataung Group are unconformable and overlained by the Plateau Limestone Group. The study area comprises the Pindaya Group (Lokepyin, Wunbye, and Nan-on Formations) and the Mibayataung Group (Linwe, Wabya Formations). The present research work involves the carbonate rocks of the Wunbye Formation (Middle Ordovicain age), and has five microfacies, namely, oolitic-dolomitized grainstone, dolomitic limestone, dolostone, oolitic- peloidal grainstone and peloidal- bioclastic wackestone.

Keywords; Mogyo Taung, Peikchin Ganaing Taung, Pindaya Group (Ordovician)

Introduction

The study areas, Mogyo Taung and Peikchin Ganaing Taung areas, are located about 25 km northeast of Ywangan Township, Taunggyi District, Shan State (south). It lies between latitude 21°11'00"N to 21°18'38"N and longitude 96°30'E, to 96°35'E bounded by vertical grids 47Q 241000 E to 245000 E and horizontal grids 47Q 2346000 N, to 23510000 N and its map reference is Myanmar Universal Traverse Mercator map sheet N0.2096 11/12 (1:50000 scale). It is also accessible from Aungban on the Thazi-Taunggyi railway, Yangon-Taunggyi or Mandalay-Taunggyi highway.

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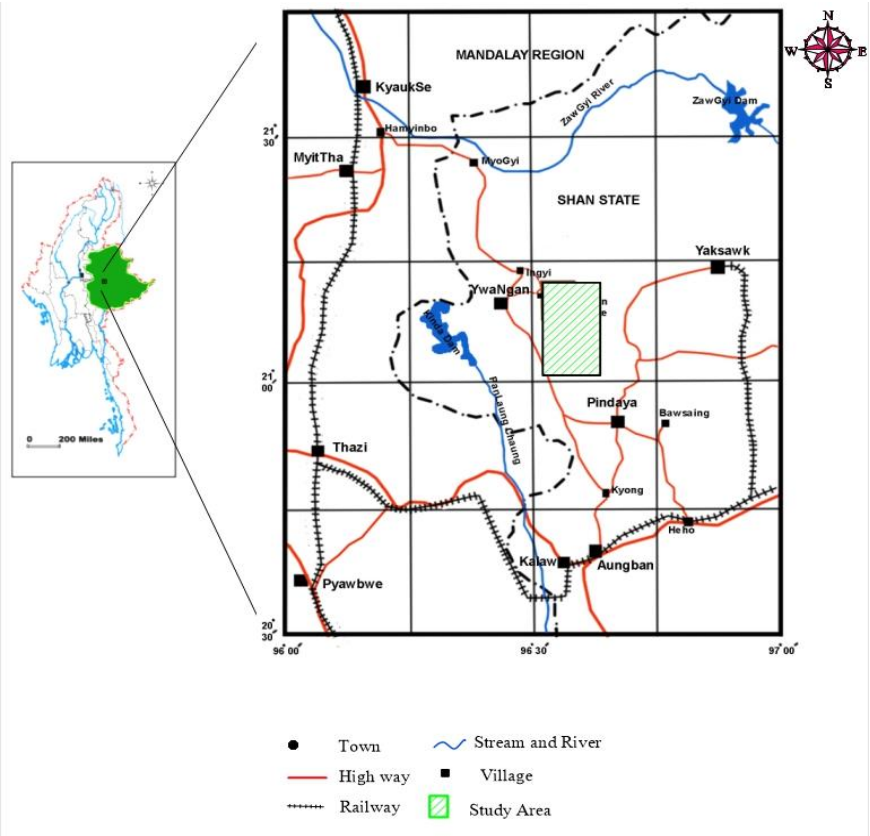


Fig.1 Location map of the study area

Regional Geologic Setting

The physiography of the study area is mountainous, and the Mogyo Taung range is trending NNW- SSE. The highest part of the study area is the peak of the Ngwetaunggyi Taung range (1714 metres). The lowest part of the study area is located near Thein gon village, about 1000 metres. The range has steep-slopes in the east and northeastern parts of the study area. There are several faults trending in the NE-SW direction, E-W direction, and NW-SE direction.The physiography of the study area is largely controlled by the Ingyi-Ingaung Fault and Karani Fault trending roughly NW-SE which gave rise to a distinct step-like feature from. A Regional geological map of the MogyoTaung and Peikchin Ganaing Taung areas is shown in Figure (2). The Precambrian rock unit, the Chaungmagyi Group, is exposed in the north of the study area. In the central and northern parts of the Pindaya range, the Molohein Group is extensively developed in the flank and southern portion by the rocks of the Pindaya Group, Mibayataung Group, limestone and dolomites of the Plateau Limestone Group**.** In the southern part, the lower Paleozoic rocks and the Mesozoic rocks of the Kalaw Red Bed are exposed.

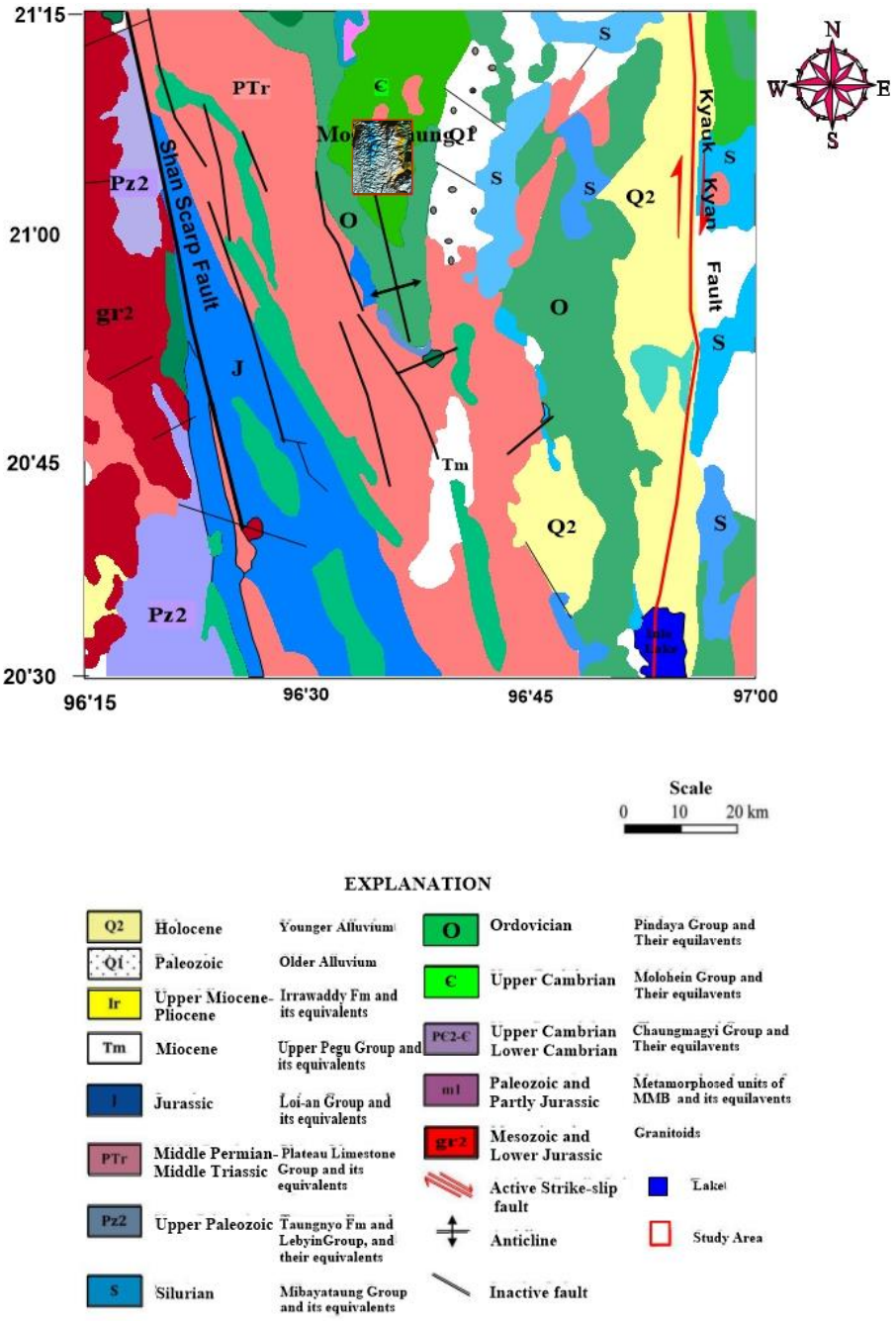


Fig. 2 Regional Geological Map of the Study Area (After MGS, 2014)

Geology of the Study Area

The study area comprises the Pindaya Group (Ordovician age) and the Mibayataung Group (Silurian age). These can be seen in Figure (3) the geological map of the study area. The present work deals with the study of the rocks of the Middle Ordovician age. The stratigraphic classification of the study area is adopted from Myint Lwin Thein (1973) for Lower Paleozoic rocks. In the study area, the Lokepyin Formation, Wunbye Formation, Nan-on Formation of the Pindaya Group, and Linwe Formation, Wabya Formation of the Mibayataung Group have been observed.

Table.1 Rock sequence of the study area

Group	Formation	Age	Lithology	Occurrence
MibayaTaung	Wabya	Middle Siluriun	Reddish brown or purple-coloured silty shale	southeast of the study area.
	Linwe	Early Siluriun	Pinkish-grey and reddish brown coloured phacoidal limestone	east and southeast of the study area.
Pyindaya	Nan-on	Late Ordovician	Yellow to buff-coloured, liminated silt stone and mudstone	south and southeast of the study area.
	Wunbye	Middle Ordovician	Grey to dark-coloured, fine-grained to micritic, silt parting and burrow nature limestone, and a minor amount of fine-grained calcareous sandstone and silt stone.	Central portion of the study area
	Lokepyin	Early Ordovician	Grey to buff-coloured (fresh) and brightly yellow-coloured (weather), medium- to thick-bedded, fine-grained siltstone and, silty mudstone	West of the study area
Molohein		Late Cambrian	Light grey to grey coloured micaceous Sandstone	north and northeast of the study area.

Source: Myint Lwin Thein, 1973

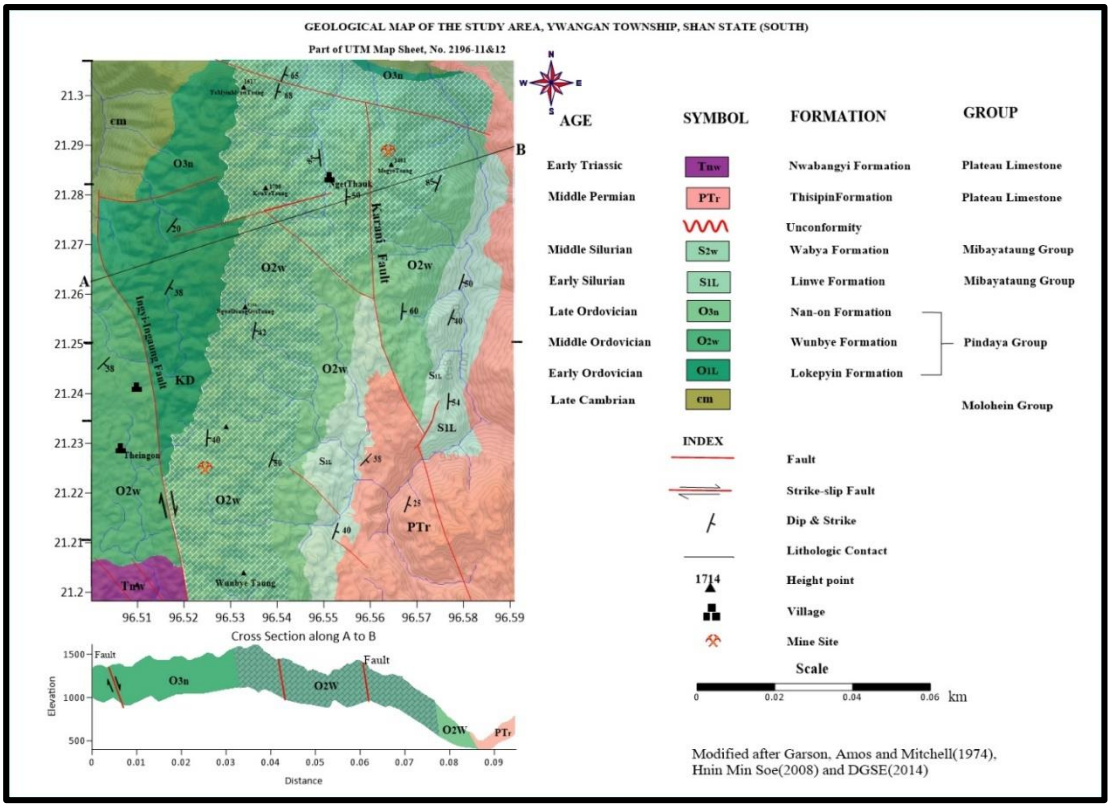


Fig. 3 Geological Map of the Study Area

Pindaya Group

The 'Pindaya Group' is a formal lithostratigraphic unit, comprising essentially of thick-bedded, burrowed, pelletal or silty limestones with irregular silt specks or laminae, and the grey or yellow siltstones. These rocks are well exposed in the Pindaya Range and Bawsaing Range.

The lower limit of this group is the Lokepyin Formation, which is in contact with the Molohein Group. The middle limit is Wunbye Formation and the upper limit is the Nan-on Formation. The type localities of the formations and members of this group are located in the northwestern part of the Pindaya Range, in Ywangan Township. The age of the Pindaya Group is regarded to be Ordovician.

The upper limit of this group, which is in contact with the Linwe Formation of the Mibayataung Group, is placed at the upper boundary of the Tanshauk Member of the Nan-on Formation, Myint Lwin Thein (1973).

Lokepyin Formation

The rocks of this formation are well exposed in the western part of the study area. In the western part of the study area, these rocks are exposed near Ngwetaunggyi Taung along the road cut of Ingyi- NgetThauk car road.

The strata of this formation generally trend NW-SE and dip to the east. Outcrop photographs of the Lokepyin Formation are shown in Figures (4-A/B). The Lokepyin Formation at its type locality comprises a succession of medium- to thick-bedded, grey-to-buff, soft-to-indurated, micaceous siltstones. Subordinate rock types are yellowish, buff to greenish marl, and hard bands of micaceous and brownish sandstones interbedded with the yellow siltstones.

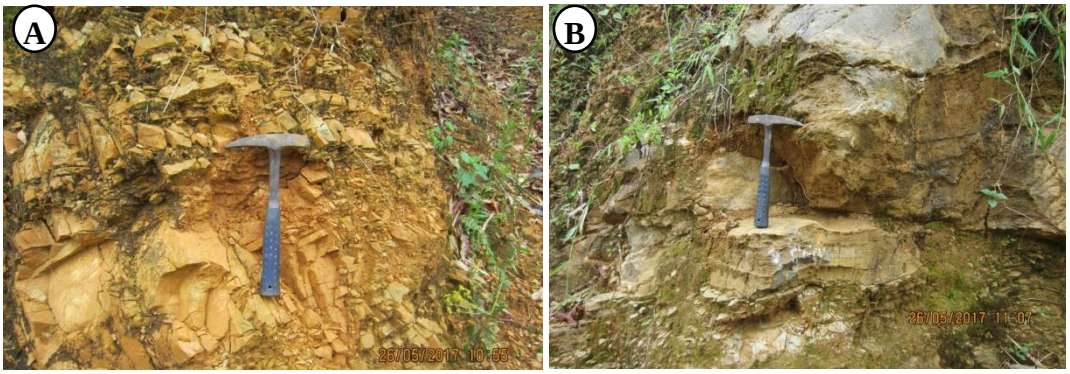


Fig. 4 (A/B)(Photograph showing medium- to thick- bedded yellowish siltstone (Lokepyin Formation). Location: 47Q 243297E 2353789N Facing 300°)

Siltstone

Lokepyin Formation at its type locality comprises a succession of medium to thick-bedded, grey to buff, soft to indurated, micaceous siltstones. Microscopically, this rock shows a fine-grained, clastic texture composed of micrite and silt-sized quartz. The size of the grain is less than 0.01 mm. The shape of quartz grains is sub-angular. Calcite and dark-brown coloured clay minerals of micrite occurred as cementing materials.

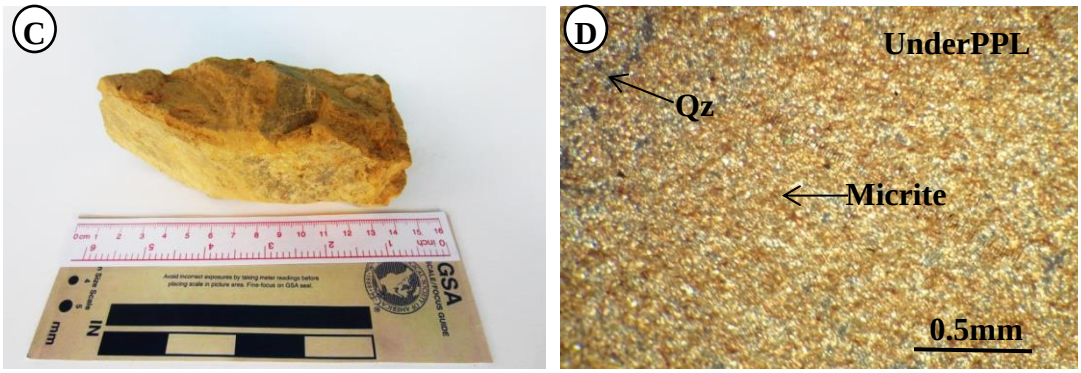


Fig.(4-C) Location:47Q 243744E 2349980N Fig.(4-D) Sample No.Tg-R- 26 Under PPL

Wunbye Formation

This formation has the largest distribution and thickness among the formations of the Pindaya Group. Wunbye Formation consists of a succession of thick-bedded to massive limestones and dolomites with minor amount of siltstones. The limestones are finely crystalline, grey to bluish grey, and with pink, buff, or yellow-coloured silty materials in the forms of burrows, specks, pellets, or irregular and regular laminations; the burrow structure is most typical of these limestones. The dolomitic limestones are usually medium to thick-bedded, often massive, but generally with laminations, and with highly jointed surfaces in a criss-cross pattern; colour is usually bluish grey or grey, although on weathered surfaces it appears dull. More or less similar suites of lithologic types are seen at other localities with slight changes in proportions of limestones to siltstone subunits.

The lower boundary of the formation, in common with the upper boundary of the Lokepyin Formation, is determined at the horizon of the first appearance of distinctive limestone beds with burrow structures or silty specks; and the upper boundary is determined at the last horizon of such limestone beds, Myint Lwin Thein (1973).

The rocks of this formation are well exposed in the central portion of the study area. Bluish grey limestones are mostly observed in the Ngwedaunggyi Taung range, Kyuye Taung range, Ingyinyay Taung, Mogyo Taung and Peikchin Ganaing Taung range in the study area. These limestone outcrops can be seen along the Ingyi- Ngwedaung- NgetThauk- Mogyo mine site car road.

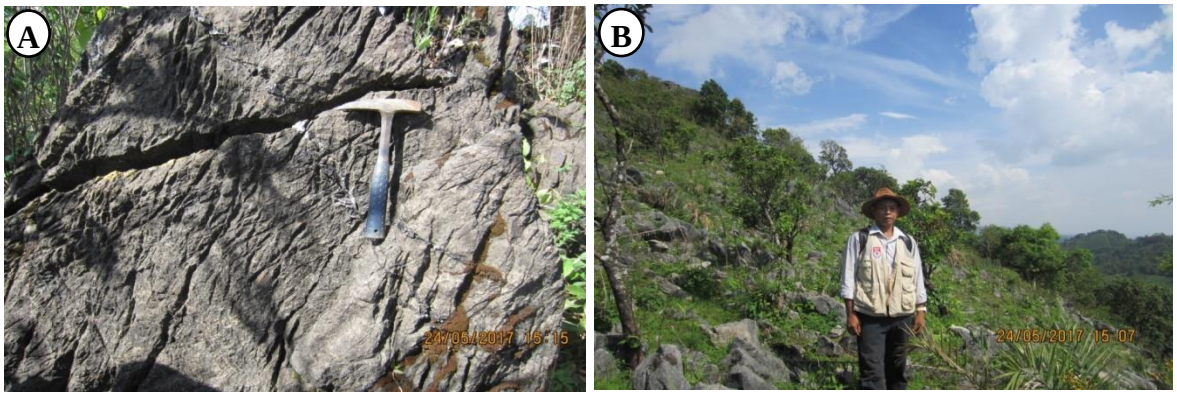


Fig. 5 (A/B) (Photograph showing thick-bedded, finely crystalline, grey to bluish grey limestone (Wunbye Formation). Location: 47Q 247895E 2355891N Facing 185°)

According to the carbonate rock classifications of Dunham (1962) and Williams, Turner, and Gilbert (1953), this formation can be classified into five types;

1. Oolitic-dolomitized Grainstone
2. Dolomitic Limestone
3. Dolostone
4. Oolitic-peloidal Grainstone
5. Peloidal-bioclastic Wackestone

1. Oolitic-dolomitized Grainstone

Oolitic-dolomitized grainstone occurs as medium to thick-bedded and massive outcrops. The weathered colour of the rock is a yellowish brown. The fresh colour of the rock is grey to bluish grey. Under a microscope, this rock is found to be allochern and replacement dolomite. Ooids are usually rounded, sometimes ellipital or spherical in shape. The excellent sorting in size and shape is distinctly characterized. Based on the constituents of oolites and dolomite, the rock can be named oolitic-dolomitized grainstone according to Dunham, (1962).

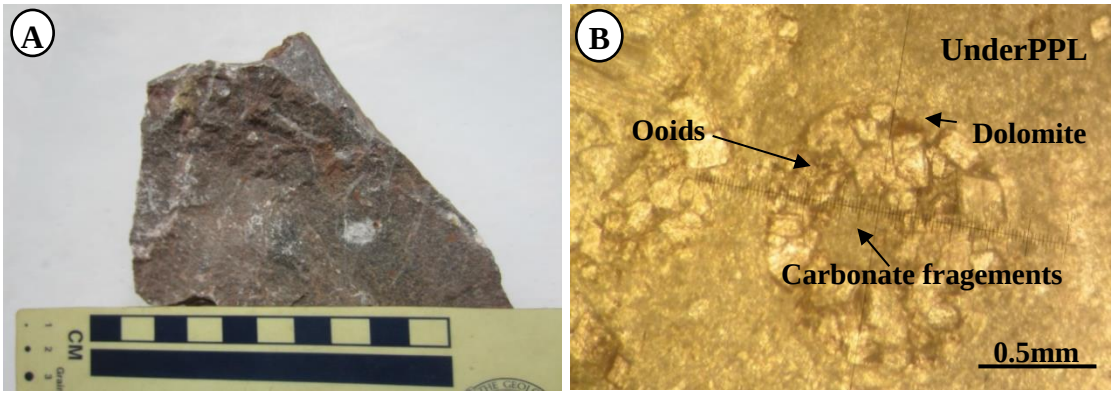


Fig.(6-A) Location: 47Q 241928E 2347323N Fig.(6-B) SampleNo.Tg- R - 39 Under PPL

2. Dolomitic Limestone

Dolomitic limestone occurs as medium-to thick-bedded and massive limestone. The weathered colour of the rock is pale yellow or reddish brown. The fresh colour of the rock is grey or light grey. Under a microscope, this rock is found to consist of 40% dolomite grains and a minor amount of microcrystalline carbonate matrix. Most dolomites have decimicron to centimicron size (0.01 - 0.15 mm) anhedral to subhedral and rhomb-shaped. The zoned, unzoned, and saddle dolomites are also observed in this thin-section. Dolomitized zonation is characterized by iron oxide rims.

Based on the constituents of dolomite grains and carbonate micrite, as well as texturally, the rock can be named dolomitic limestone by Williams, Turner and Gilbert, (1953).

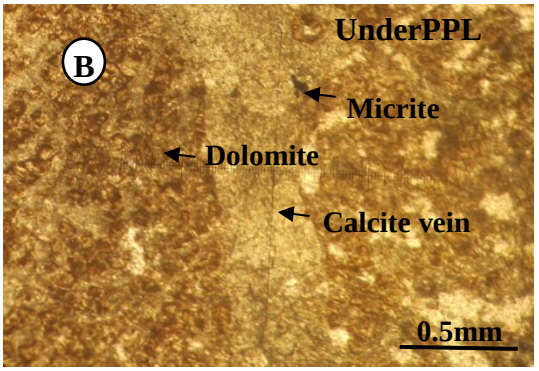
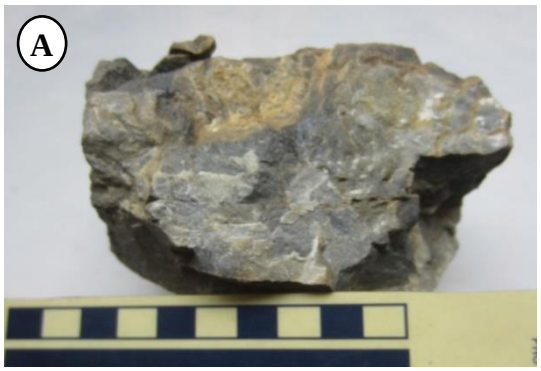


Fig.(7-A) Location: 243265E 2349228N Fig.(7-B) Sample No.Tg-R- 31 Under PPL

3. Dolostone

Dolostone occurs as medium-to thick-bedded limestone. The weathered colour of the rock is a reddish brown. The fresh colour of the rock is grey or light grey. These rocks are well-exposed near Peik Chin Ganaing Taung in the study area. Under a microscope, this rock is found to consist 80% of dolomite grains and a minor amount of microcrystalline carbonate mud. Most dolomites are decimicron to centimicron size (0.05 - 0.2 mm) subhedral to eubhedral and rhomb-shaped, and are zoning. Dolomitized zonation is characterized by iron oxide rims. Calcite and clay minerals occur as cementing materials. Based on the higher content of dolomite grains and smaller content of carbonate mud, as well as texturally, the rock can be named dolostone by Dunhum, (1962).



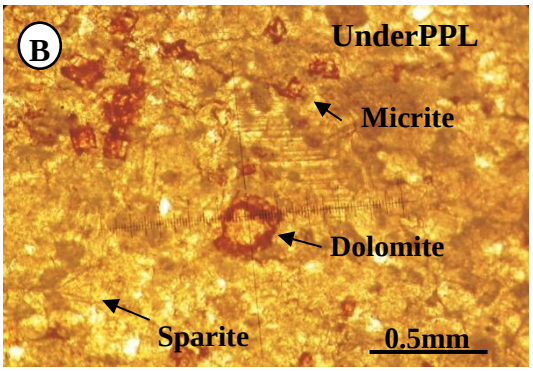


Fig.(8-A) Location: 47Q 242359E 2347936N Fig.(8-B) Sample No.Tg-R- 8 Under PPL

4. Oolitic-peloidal Grainstone

Oolitic-peloidal grainstone is a grey or light grey coloured limestone. It is compact and medium-bedded. Some calcite stringers are cross-cutting the limestone. These rocks are exposed in the eastern part of the study area. Under a microscope, this rock is found to consist of 60% ooids, 20% of pellets or peloids, and a few are sparite and others. Ooids are well-rounded and moderately sorted but loosely packed. The shape of pellets or peloids is ellipsoidal to irregular, and the sizes vary. The intrestitial pore space between pellets is filled with sparry calcite. Based on the higher content of oolitic grains and with a minor amount of pellets or peloids, and a smaller content of carbonate particles, as well as texturally, the rock can be classified as oolitic-peloidal grainstone according to Dunham (1962).

Fig.(9-A) Location: 47Q 242842E 2348004N

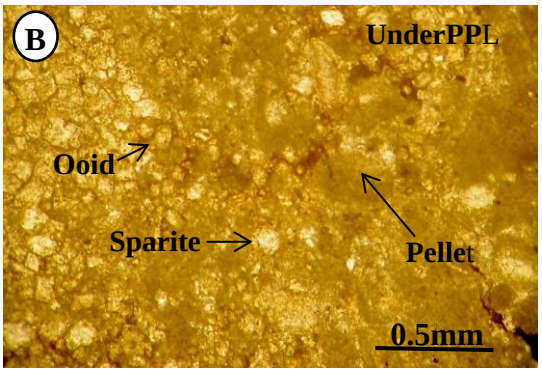


Fig.(9-B) Sample No.Tg-R- 44 Under PPL

5. Peloidal-bioclastic Wackestone

Peloidal-bioclastic Wackestone is a grey or dark grey colored limestone. It is well compacted, and has a massive outcrop. Some calcite stringers are cross-cutting the limestone. These rocks are exposed in the south eastern part of the study area near Wunbye Taung. Under a microscope, this rock is found to consist of 60% of pellets and peliods, 20% of bioclasts, and 20% of micrite and others. The shape of pellets or peloids is subrounded, ellipsoidal to irregular, and they vary in size. Micrite cemented the pellets and peloids, and sparry calcite cement is found in vein stringers. Based on the higher content of pellets and peloids, and the constituents of carbonate cement and a few bioclasts, they can be classified as peloidal-bioclastic wackestone according to Dunham (1962).

Fig.(10-A) Location: 47Q 244627E 2346518N

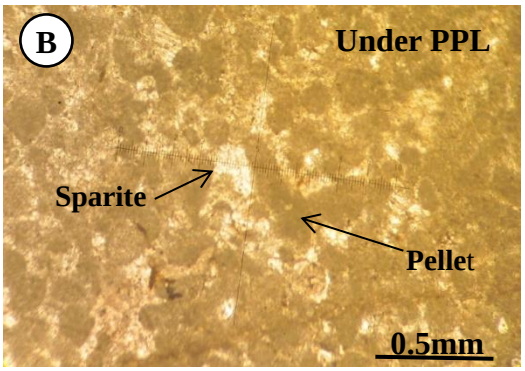


Fig.(10-B) Sample No.Tg-R- 36 Under PPL

Nan-on Formation

The Nan-on Formation consists of yellow to buff, subindurated to soft, thin to medium bedded siltstones, mudstones, and marlstones, micaceous to calcareous shale, and thin bands of laminated and argillaceous limestones which occur interbedded with the siltstones. Siltstones are medium-grained, buff-coloured, thin-bedded, and slightly calcareous. This formation is highly fossiliferous.

The rocks of this formation are exposed in the southern and southeastern parts of the study area. In the southern part of the study area, near Thapanbin village, this formation is well exposed and trending 240°. The Siltstone of the Nan-on Formation can be seen in Figures 11 (A/B). The lower boundary of the formation is marked at the contact of the siltstones with the topmost limestone bands of the Wunbye Formation, which have burrow structures filled with silty materials, or silty laminations. The upper boundary is demarcated at the point of the first appearance of the purple band of the overlying Tanshauk Member, Myint Lwin Thein (1973).

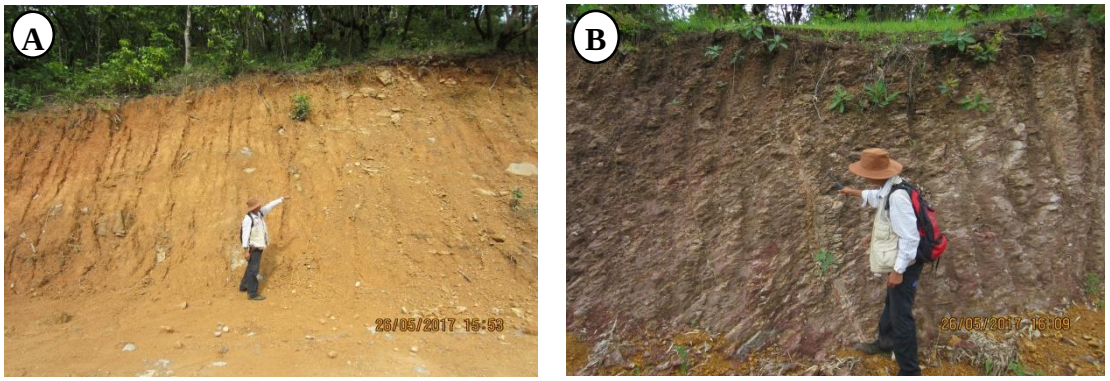


Fig. 11 (A - B) Photograph showing buff coloured, subindurated to soft, thin- to medium-bedded siltstone (Nan-on Formation). Location: 47Q 246276E 2353050N Facing 250°

Mibayataung Group

The Mibayataung Group comprises the Linwe Formation, Wabya Formation and the Taungmingyi Member. The lower limit of the Mibayataung Group is marked at the lower boundary of the Linwe Formation where the phacoidally textured limestones appear. The upper boundary, pink or purple, grey shale of the Wabya Formation or quartzites of the Taungmingyi Member, is uncomformably in contact with the massive limestones or dolostones of the overlying Plateau Limestone Group. The rocks of this group are well exposed at Linwe, Pegin, and Kyauktaw on the western margin; at Wabya on the southern margin; and at Kyauksu and Kya-in-kan on the eastern margin of the Pindaya Range, Myint Lwin Thein (1973).

Linwe Formation

The Linwe Formation consists of purple, pink, and grey-coloured, phacoidal limestones, argillaceous limestones, calcareous mudstones, and shales, while some of the shales exhibit purple colour. There are lateral variations of rock types within the formation. The limestones might appear as a thick unit in one place and disappear laterally to be replaced by grey or purple shale.

The rocks of the Linwe Formation are exposed in the south and southeastern parts of the study area. Outcrop photographs of the Linwe Formation are shown in Figures 12(A-B). The lower boundary of the Linwe Formation is determined at the horizon of contact of phacoidally textured limestones or grey shales with the purple siltstones or shale of the

underlying Tanshauk Formation. The upper boundary is demarcated at the horizon of the last occurrence of the phacoidal limestones or purple shales of the formation which is in contact with the lower boundary of the Wabya Formation, Myint Lwin Thein (1973).

Fig. 12(A/B) Photograph showing purple, pink and grey phacoidal limestone near the monastery of Thapanbin village (Linwe Formation). Location: 47Q 246104E 2352154N Facing 90°

Ferruginous Lime Mudstone

Ferruginous lime mudstone is a grey, pink, and purple coloured limestone. It is compact and massively bedded and shows the linguoid ripple marks on the bedding planes. The shape of ripple marks is similar to mud cracks. Under a microscope, this rock is found to consist of carbonate mud, bioclasts, and a minor amount of calcite and micrite. *Ostracods* are found in this limestone. Based on the higher content of carbonate mud, and other constituents of bioclasts, calcite and sparite can be classified as ferruginous lime mudstone according to Dunham (1962).

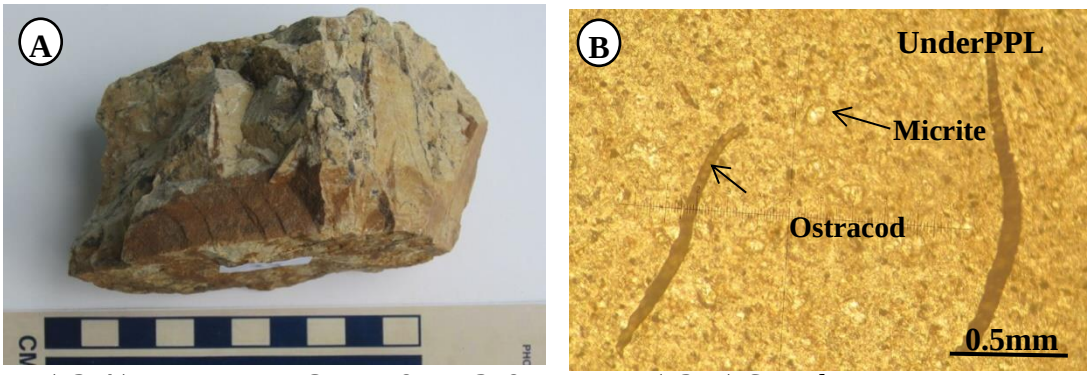


Fig.(13-A) Location: 47Q 244492E 2349241N Fig.(13-B) Sample No.Tg-R- 33 Under PPL

Wabya Formation

The Wabya Formation comprises light grey, reddish brown coloured, soft to subindurated, micaceous or non-micaceous shales and silty shale. The rocks of the Wabya Formation are exposed in the east and southeastern parts of the study area. In the eastern part of the study area, this formation is narrowly exposed and trends nearly N-S.

The lower boundary of the Wabya Formation, which is in contact with the upper boundary of the Linwe Formation is determined at the horizon of the last occurrence of the phacoidal limestones or calcareous mudstones, or purple shales of the latter. The upper boundary is unconformably situated below the Molohein Group, Myint Lwin Thein (1973).

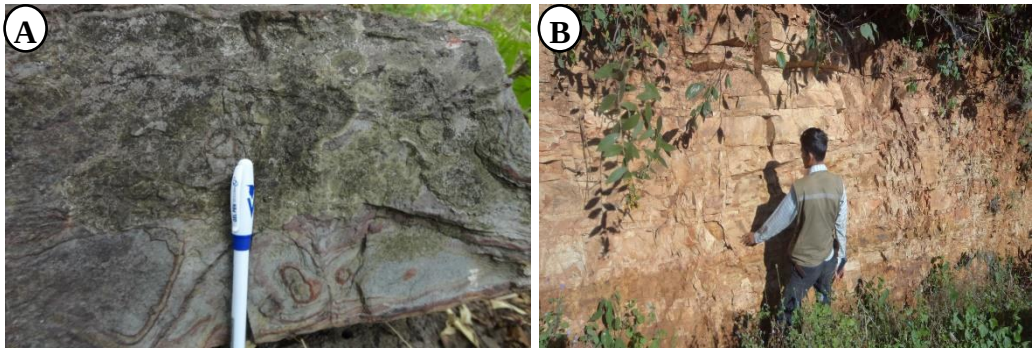


Fig. 14 (A / B) Photograph showing purple or reddish brown coloured, soft to subindurated silty shales (Wabya Formation). Location: 47Q 247783E 2352596N Facing 260°

Silty shale

The silty shale of the Wabya Formation is purple or reddish brown in colour and massively bedded. Under a microscope, this rock is found to consist of finely-liminated carbonate shale and a minor amount of calcite. Shale consists of micro-crystalline micaeous clay, oriented so that tiny flakes of clay minerals are roughly parallel to the bedding plane. It is composed of carbonate shale at 70%, calcite at 30% and others at 30%. Based on the higher content of finely-liminated carbonate shale, as well as texturally, the rock can be classified as silty shale according to Williams, Turner, and Gilbert (1953).

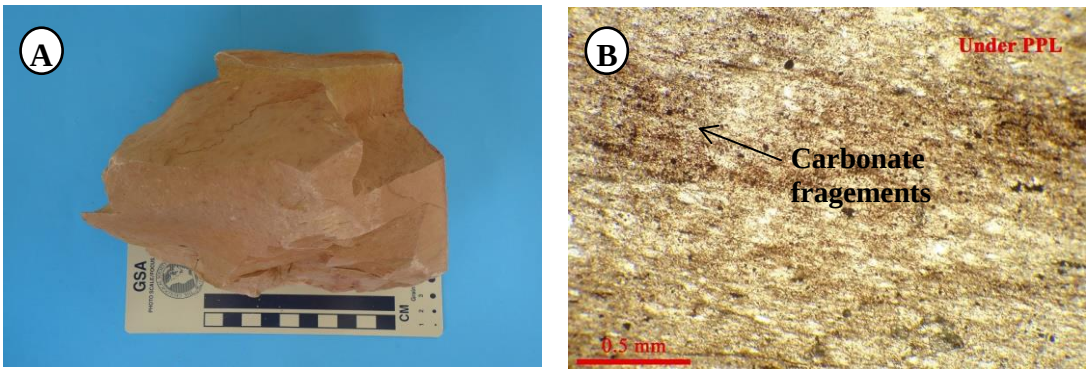


Fig.(15-A) Location: 47Q 247783E 2352596N Fig.(15-B) Sample No.Tg-R- 56 Under PPL

Summary and Conclusion

The study area, Mogyo Taung and Peikchin Ganaing Taung areas lies about 25 kilometres northeast of Ywangan, Taunggyi District, Shan State (South), covering an area of approximately 64 square kilometres. Actually, the study area is located in the northwestern part of the Pindaya Range.The major structure, the Pindaya Range, is regarded as a south-plunging anticline where the Precambrian rocks of the Chaungmagyi Group are surrounded by Early Paleozoic rocks. The study area comprises the Pindaya Group of the Ordovician Age (Lokepyin, Wunbye, Nan-on Formations) and the Mibayataung Group of the Silurian Age (Linwe, Wabya Formations).

The present research work involves the petrography of carbonate rocks of the Wunbye Formation (Middle Ordovicain age) and reveals at least five microfacies, namely, oolitic-dolomitized grainstone, dolomitic limestone, dolostone, oolitic-peloidal grainstone, and peloidal- bioclastic wackestone, which hosts the lead ore mineralization. The bodies of galena-bearing brecciated dolomitized zones and barite veins occur generally as sills conformably

intruding along the bedding planes of the fine-grained bluish-grey to dark grey limestone host rocks.

Acknowledgement

I would like to express my sincere gratitude to Prof. Dr. Day Wa Aung, (Professor and Head, Department of Geology, University of Yangon) for his encouragement, permission, and helpful suggestions in preparing my research work. I am greatly indebted to Dr. Soe Win (Retired Professor Emeritus, Department of Geology, University of Yangon) for his invaluable lectures on various aspects of economic and mining geology. I sincerely thank all the local people of the Theingon and Tabyinbyaw villages and responsible people from Harbor Star Mining Co. Ltd. for their kind help, full logistics and facilities, and warm hospitality during my field work.

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