

UNIVERSITY OF YANGON DEPARTMENT OF GEOLOGY

GEOLOGY AND GEOCHEMICAL INVESTIGATION OF LEAD MINERALIZATION IN THE WEST OF YEBU AREA, THAZI TOWNSHIP, MANDALAY REGION

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2 MSc (Geol) – 20
Economic and Mining Geology**

*Conference Room (DGSE)
Gems Museum*

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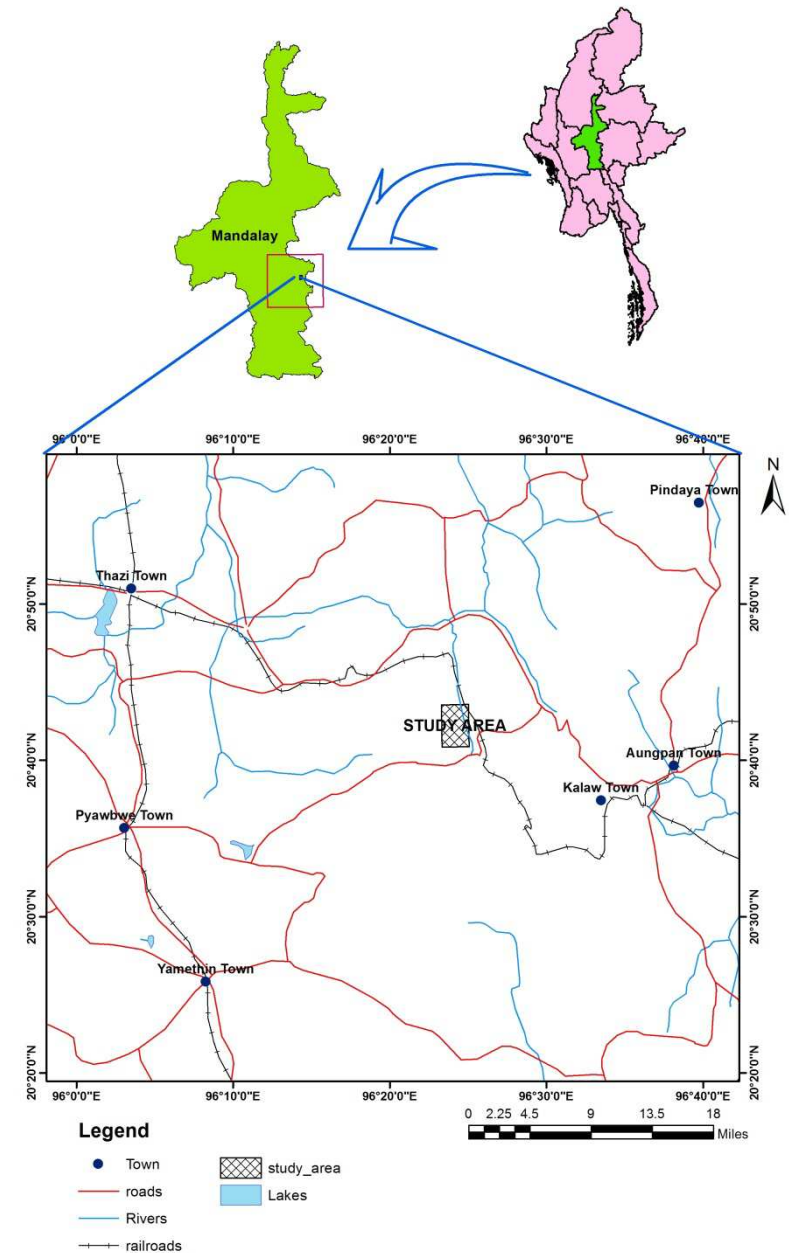
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INTRODUCTION

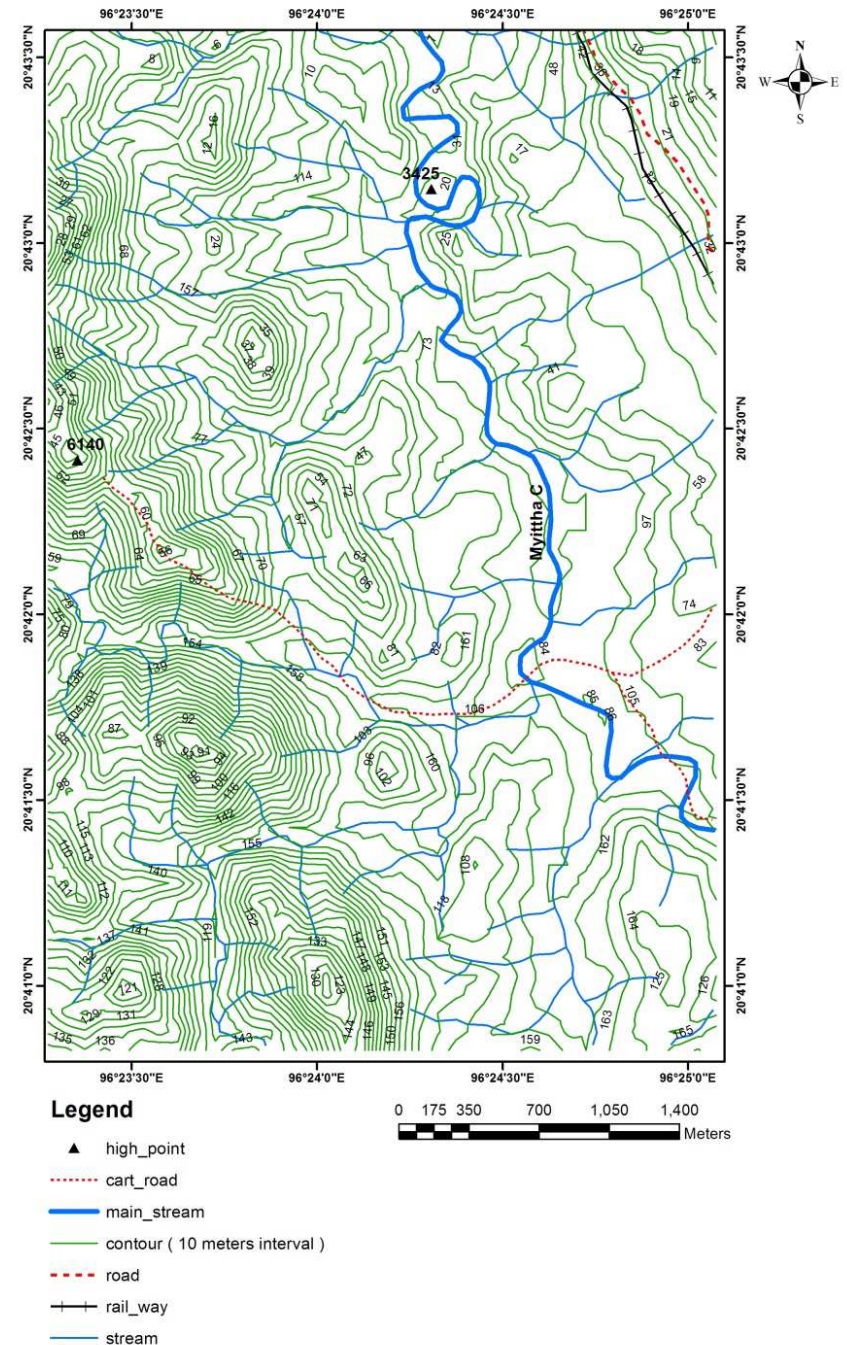
Location and Size and Accessibility

- located about (65) Km SE of Thazi Township, Mandalay Region
- Western part of Yebu village
- Yebu village – lies just beside Thazi to Shwe Nyaung railroad
 - Latitudes - 20 °40' 50''N to 20 °43' 34''N
 - Longitudes - 96 ° 23' 20''E to 96 ° 25' 04''E
- UTM map of 2096/06
 - horizontal grid - 2289000 N to 2294000 N
 - vertical grid - 228000 E to 231000 E
 - Total coverage area - (15) square kilometers



Physiography and Drainage

- * Moderate to high relief
- * Altitude – 600 to 770 meters
- * Lies along the western margin of eastern highland of Shan Plateau
- * Dominant features – NNW trending fault (Shan Scarp)
- * Myittha Chaung is typical main stream that flow from South to North direction (Dendritic pattern)



Climate and Vegetation

- * **Climate**

- * Tropical region
- * Annual rainfall - 60 to 80 inches
- * Temperature
 - * 38°C (Maximum)
 - * 15°C (Average)
 - * 4°C (Minimum)

- * **Vegetation**

- * Dense
- * Soil cover is very thick
- * Mostly common Pine, Inbin, Ingyin, and Bamboos
- * Cultivated in flat and rolling hill areas - Rice, Banana, Papaya and Sanundet (Turmeric).
- * Famous for commercial timber such as Teak and Hardwood.

Purposes of Study



To prepare the **geological map** of the study area.

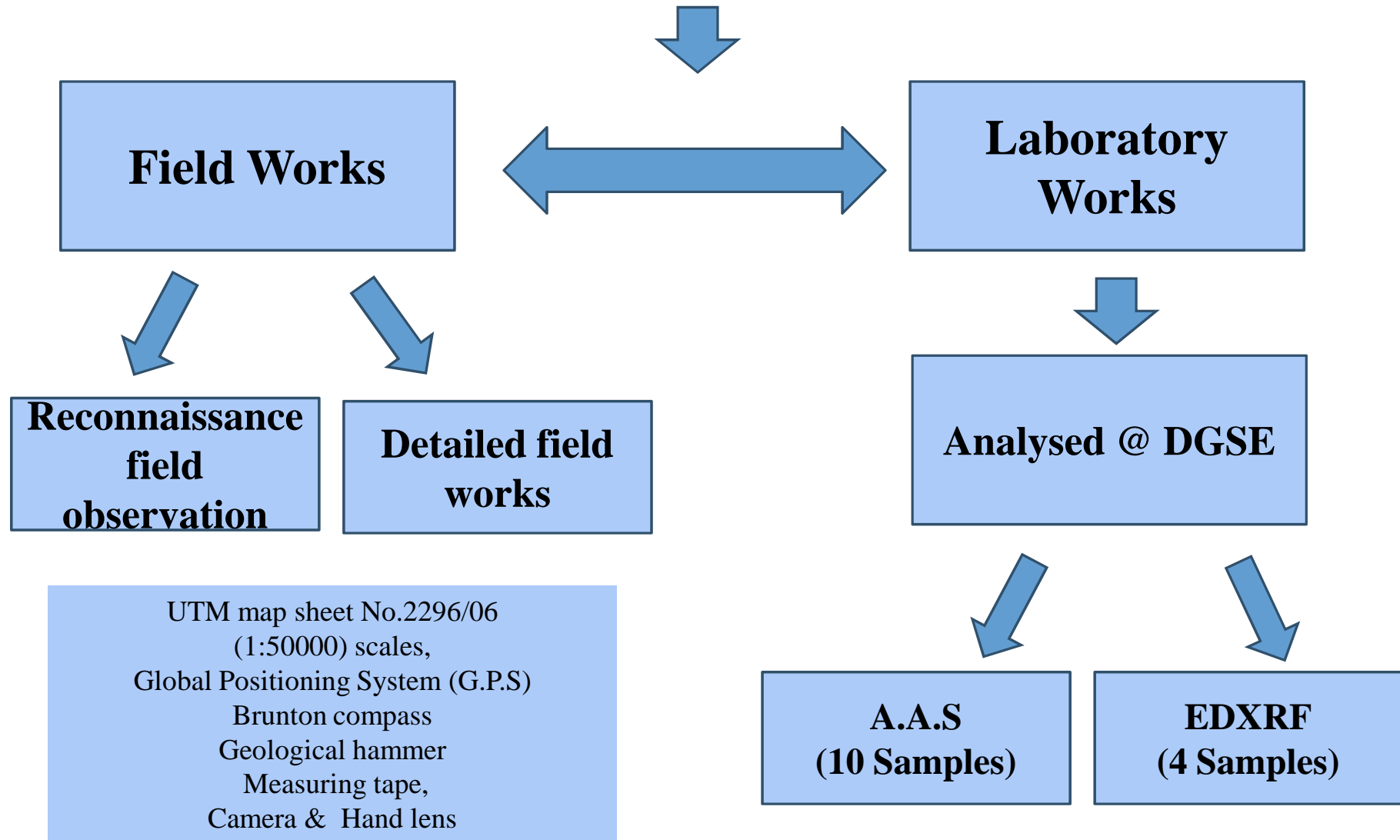
To study the **geology, petrography** and **alteration** of the study area

To describe the occurrences of **lead mineralization style**

To identify the **ore minerals** and their **paragenetic sequences**

To investigate the **geochemical association** of lead mineralization

Methods of Study

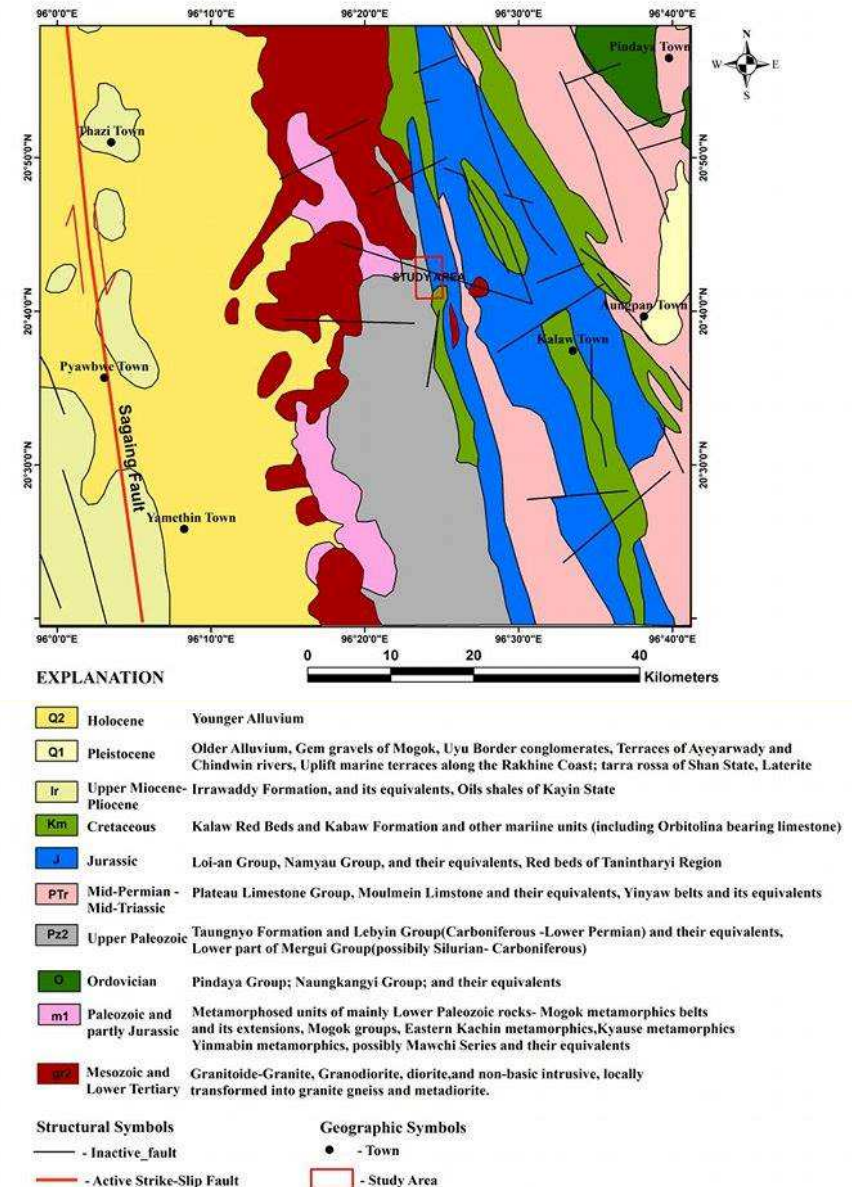


Previous Works

- * In 1934, Chibber, H.L made research the Geology of Burma, including the study area. In 1942, A.B.Dutt first mapped a wide region including the present area on a reconnaissance level.
- * In 1965-1968, U Phone Myint and U Than Htay (MDC) was carried out a series of geochemical survey in Lebyin area.
- * In 1973, Aung Myint Thein and Myo Min, mapped the eastern parts of Pyawbwe, Yamethin and Tatkon Townships.
- * In 1974, Shwe Win mapped the Lebyin_Shweminbon area and first mentioned the carboniferous age for the so-called Lebyin group.
- * In 1976-1978, DGSE cooperated with UNDP carried out for regional mapping and geochemical, geophysical survey with emphasis on the antimony mineralization at Lebyin area.
- * In 1977, National Stratigraphic committee prepared a regional geological map of the Lebyin area.
- * In 1985, Tun Soe mapped the Lebyin Group and the subdivided into four stratigraphic unit of formation rank.
- * In 1986-1991 Soe Thiha et.al (DGSE) carried out gold exploration at Lebyin_Shweminbon environs.
- * In 1998-2004, IMHLE investigated for gold and antimony exploration around Shweminbon – Lebyin areas.
- * In 2012-2015 Aung Kyaw Moe et.al (DGSE) studied for minerals exploration at Lebyin-Poklokkale vicinity.

REGIONAL GEOLOGIC SETTING

- Myanmar is **situated** in an area of **complex plate tectonic setting**.
- **Divided** from west to east into **four major geotectonic units** and also geomorphologic provinces as:
 - The **Rakhine Coastal Plain**,
 - **Western Ranges**,
 - The **Central Lowlands** and
 - The **Eastern Highlands**.
- The Sino-Burman Ranges or the **Eastern Highlands Belt** is an **important tectonic domain** of Myanmar.
- It **comprises** the **Shan Plateau** and the **Tenasserim** area.
- The rocks are mostly **Paleozoic sediments** folded and partially metamorphosed.
- In the **Palaeozoic**, there are **two important carbonate series**:
 - The **Ordovician- Silurian carbonate series**, and
 - The so-called “**Plateau Limestone**” of Carboniferous-Permian age
- **Two clastic series** are
 - The **Mawchi-Mergui series** of Upper Palaeozoic exposed in the western **Shan Plateau** and **Tenasserim region**, and
 - The **Cambrian clastic series** exposed in the **southern and northern shan states**



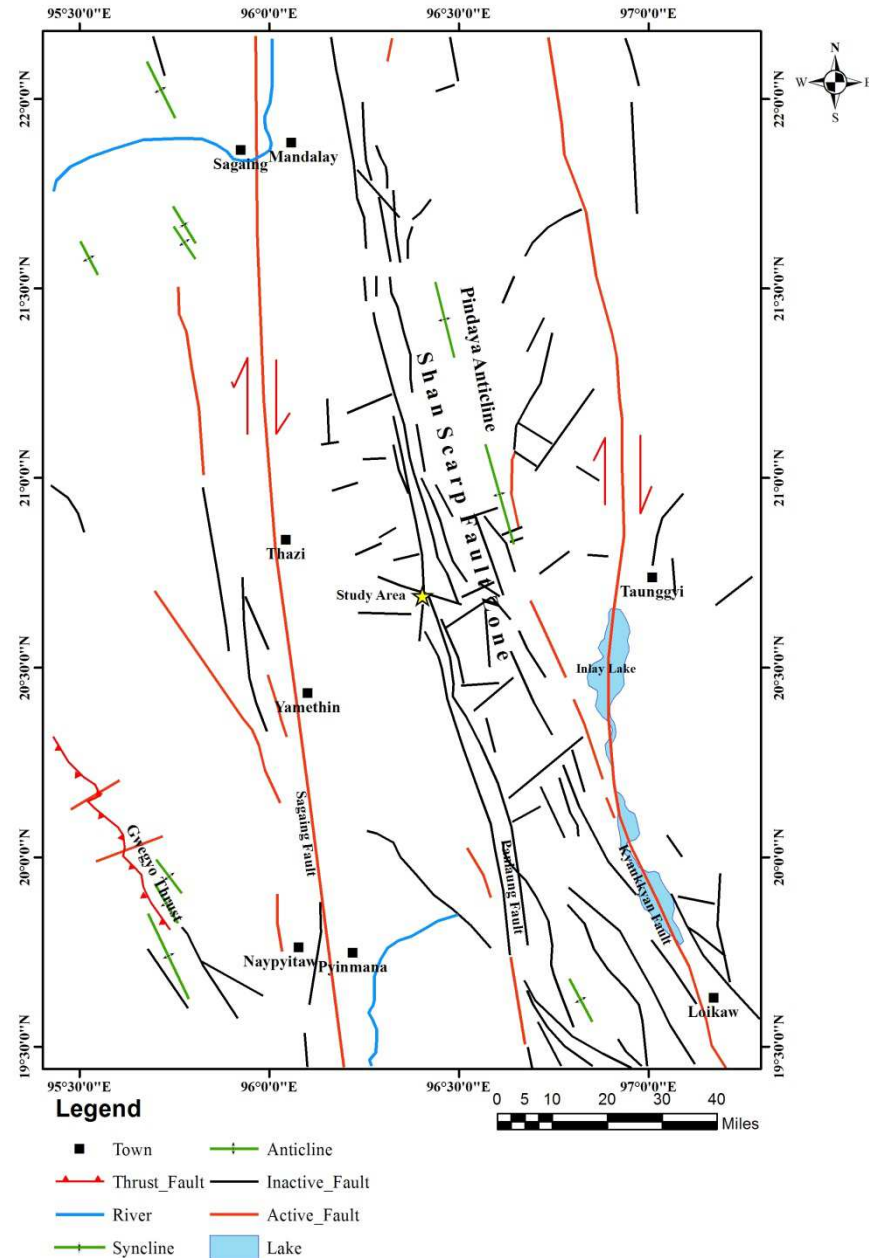
REGIONAL GEOLOGICAL MAP OF THE STUDY AREA
(After Myanmar Geoscience Society, 2014)

Summary of the geological evolution in the Shan Plateau (Goossens, 1978)

Cenozoic to Recent	Continental erosion and weathering. Karst topography. Tectonic movements, block-faulting responsible for the reactivation of sinkholes, dissolution cavities. Lacustrine sedimentation.
Early Cenozoic to end of Mesozoic	Emplacement of granitic batholiths. Final emergence of the Shan-Tenasserim region. Deposition of conglomerates, red sandstones and siltstones (Kalaw Red Beds).
End of Jurassic	Calc-alkaline volcanism to the west and granitic intrusions to the east.
End of Paleozoic	Orogenic movements responsible for an early stage of folding and faulting. Epiorogenic movements and emergence of parts of the Shan area.
Upper Paleozoic	Deposition of clastic turbidite sediments (Lebyin Formation) in north-south trending troughs.
Lower Carboniferous	Partial emergence of the area during the Devonian and part of the Silurian (red Shales and coal-black shales). Dissolution cavities in the underlying Ordovician limestones.
Lower Paleozoic	After deposition during the Ordovician of shallow marine carbonates, calc-alkaline volcanism near Bawdwin and granitic intrusions in the eastern part of the Shan State. Clastic sedimentation over the Pre-Cambrian basement, possibly forming some islands.

Regional Structure

- **Shan Scarp Fault** is one of the **major faults** which affected in the study area.
- This is the largest and topographically most conspicuous fault.
- It is **running North- South** and located at the eastern part of the study area.
- The fault trace is **noticed by** the high and prominent **Pyinyaung scarp**.
- It forms **faulted contact between** the **plateau limestone** in the **east** and the **Mesozoic unit** in the **west**

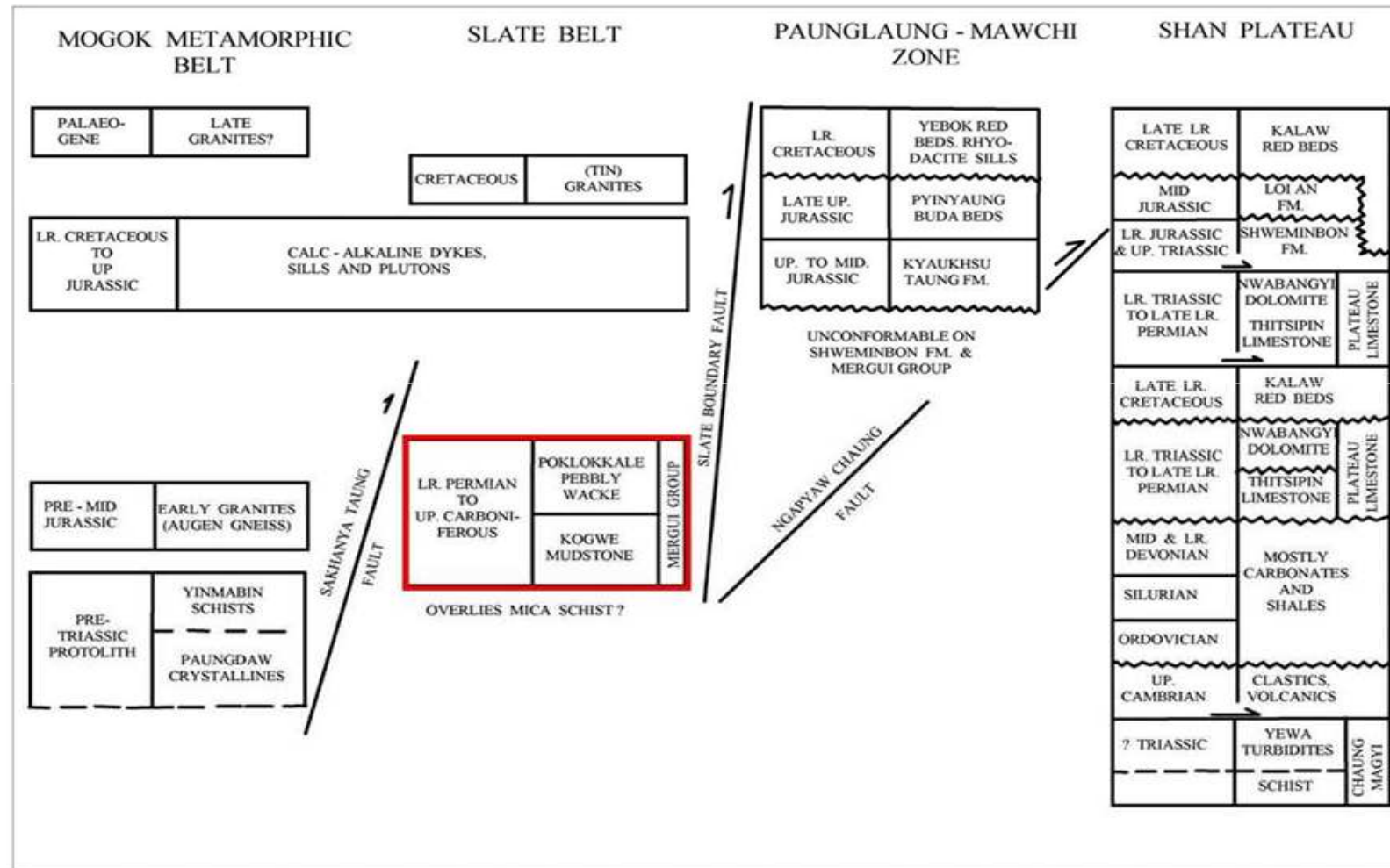


**Regional structural map of the study area.
(After Myanmar Geoscience Society,2014)**

GEOLOGY OF THE STUDY AREA

Group	Rock Unit	Lithology	Age
	Alluvium Unconformity	Soil and Gravel Beds	Quaternary ~~~~~
		Travertine ~~~~~	
	Pyinyaung Formation	Sandstone interbedded with shale , conglomerates and mudstone	Cretaceous (Oo et.al., 2002/ UN1978)
	Kyaukhsu Taung Formation	Sandstone, quartzose Sst and locally brecciate silicified sandstone	Up. Jurassic (Oo et.al., 2002/ UN1978)
Slate Belt			
Mergui Group	Poklokkalae Pebbly Wacke	Carbonate rocks	Lr Permian to Up Carboniferous
		Pebbly mudstone , sandstone and silicified rocks	
	Kogwe Mudstone	Indurated mudstone and Slate	

Stratigraphic chart showing rock units in central Myanmar Structural Zone



After by Mitchell et al(2004)

3.2.1 Kogwe Mudstone

- * Mostly exposed in the western part and central part of the study area
- * Well exposed along the Kogwe Chaung
- * Grey to dark grey coloured medium bedded to massive indurated mudstone
- * Locally occurs slate
- * Localized area Qtz and Calcite veinlets are also observed
- * Most exposures are highly weathered and crushed.
- * Upper Carboniferous to Lower Permian



Loc: N 20 °42' 52" E 96 ° 23' 50"

Facing: N

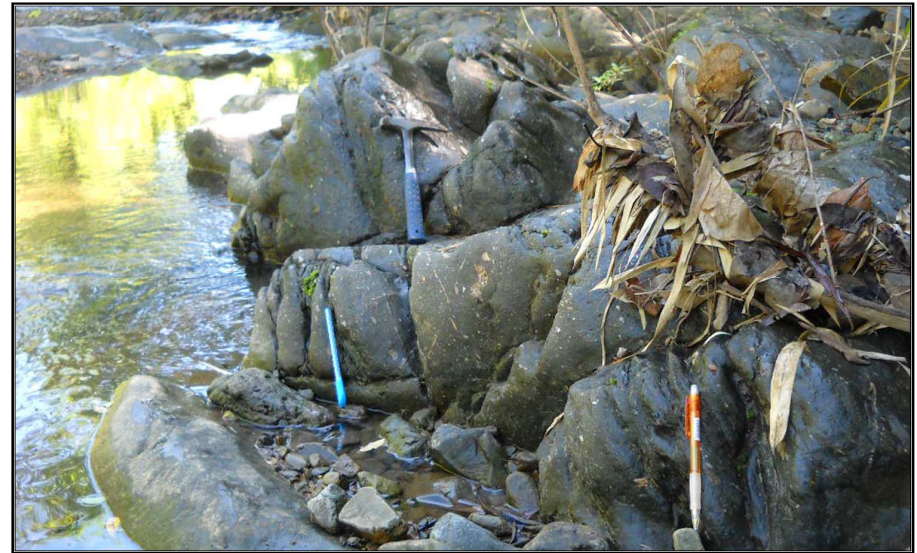


Loc: N 20 °42' 50" E 96 ° 23' 47"

Facing: 60 °

3.2.2 Poklokkale Pebbly Wacke

- * Widely distributed in the study area
- * The name was taken from the stream of pokloke chaung
- * Mainly comprise yellowish brown and grey coloured medium to thick bedded and massive pebbly mudstone and pebbly sandstone and quartzose sandstone.
- * Pebble sized are ranging between 0.2 to 15 cm (sub angular to subrounded)
- * Upper Carboniferous to Lower Permian



Loc: N 20 °41' 42'' E 96 ° 24' 06''

Facing: N



Loc: N 20 °43' 00'' E 96 ° 23' 44''

Facing: N

3.2.3 Carbonate Rocks

- * These carbonate rocks belong to **Mergui Group**
- * Locally outcrop as **lens shaped**
- * Composed of **Limestone**, locally **dolomite** and subordinate amount of **brecciated limestone**
- * **Associated** with **galena mineralization**
- * massive **limestone & dolomite** with **calcite veinlets** and locally **tarnishes**
- * Usually observed with **faulted contact** together with younger units of **Kyaukhsu Taung Formation**
- * Upper portion of the Mergui Group of **Permian age**



Loc: N 20 °43' 51" E 96 ° 25' 01"

Facing: N



Loc: N 20 °41' 42" E 96 ° 25' 15"

3.3 Kyaukhsu Taung Formation

- * Mainly **composes** of grey, pinkish to reddish coloured thin to medium bedded **quartzose sandstone**
- * **Locally silicified** and **brecciated**
- * May be **deposited** as a **basin**
- * **Surrounded** by **Mergui Group** of sedimentary and metasedimentary rocks
- * **Upper Jurassic** (Oo et.al 2002)



Loc: N 20 °42' 53'' E 96 ° 23' 45''
Facing: 350 °



Loc: N 20 °43' 31'' E 96 ° 23' 45''
Facing: 350 °

3.4 Pyinyaung Formation

- * Well **exposed** at north eastern part along the **railway section**
- * Mainly **composed** of buff to yellowish coloured medium to thick bedded **sandstone interbedded shale, conglomerate and mudstone**
- * **Interbedded layers** are generally **2 to 6 inches in thickness**
- * Single lithology of **sandstone** have thickness of more than **3 metre**
- * **Shale and mudstone** are **soft and fissile**
- * The **age** of the unit is **Cretaceous** (Oo et.al.,2002)



Loc: N 20 °43' 22" E 96 ° 24' 58"

Facing: SE



Loc: N 20 °43' 28" E 96 ° 24' 56"

Facing: 130 °

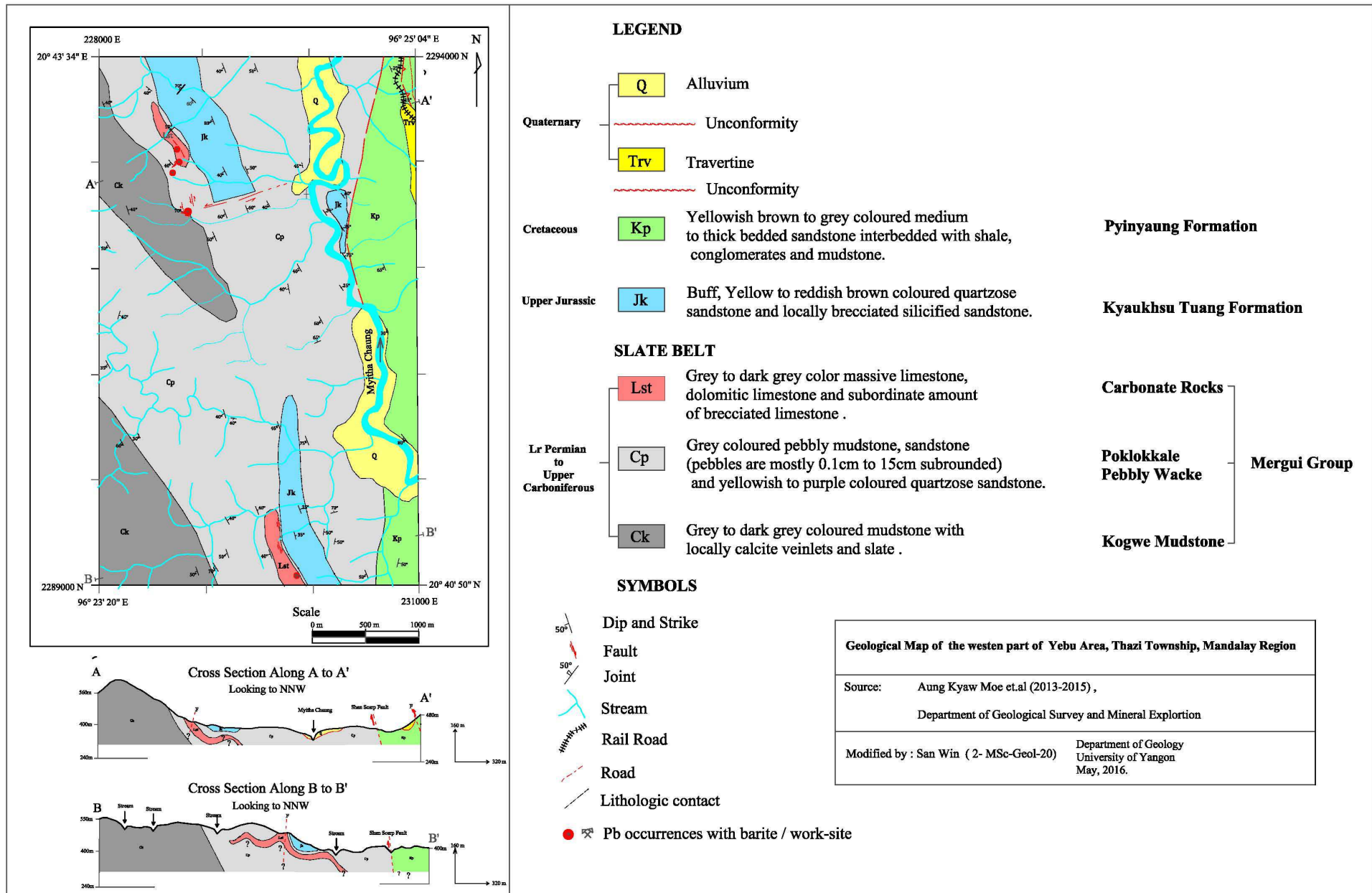
3.5 Travertine

- * Occur as a superficial unit
- * Partially cover the Pyinyaung formation and base of Plateau limestone outcrop
- * Buff to light brown coloured and characteristically porous and banded
- * About a few meter in thickness
- * The source of this travertine is obviously from the eastern part of high mountain range (Plateau Lst)



Loc. N 20° 43' 20" E 96° 24' 58", Facing – Due east

GEOLOGICAL MAP OF THE WESTERN PART OF YEBU AREA, THAZI TOWNSHIP, MANDALAY REGION



PETROGRAPHY OF THE STUDY AREA

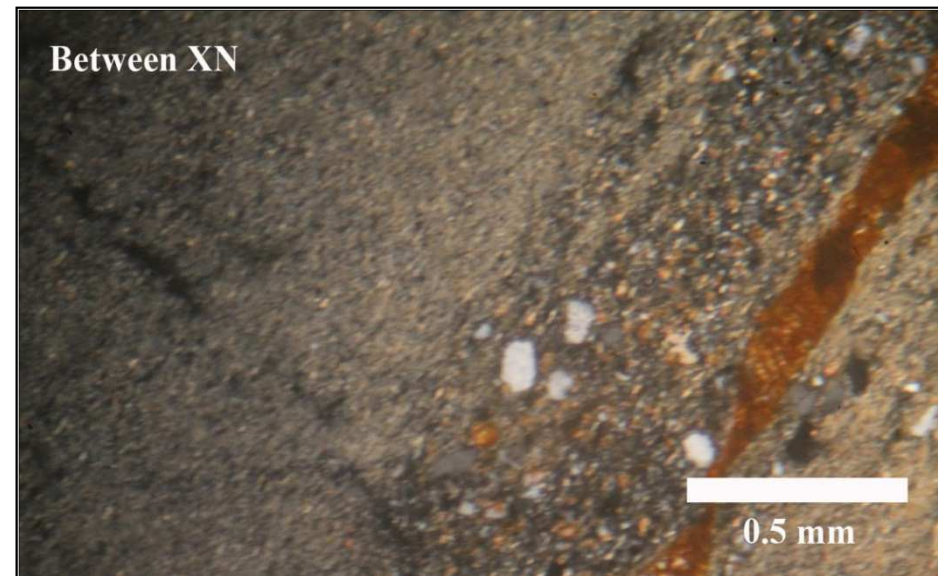
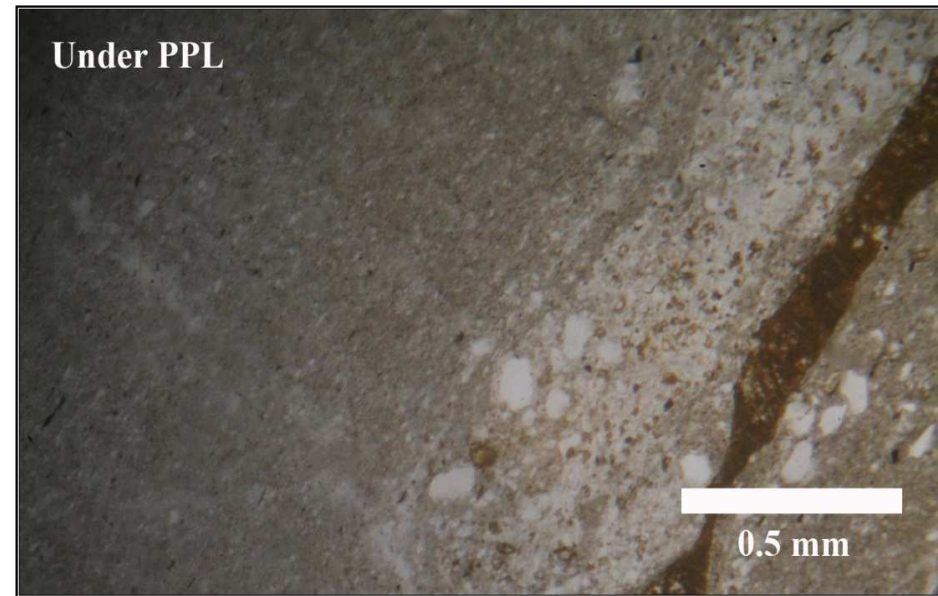
4.1 Introduction

- * Thin section for detail petrographic studies by using transmitted light polarizing microscope
- * Purposes – to understand the *alteration, paragenetic & mineralization*.

4.2 Mergui Group

4.2.1 Slate

- * Fine grained , slaty texture and iron stained
- * Mainly composed of sericite, opaque specks and quartz minerals
- * Sericite and quartz are occurs *parallel foliation* between XN
- * Quartz is mostly silt to sand sized (ranging between 0.2mm)

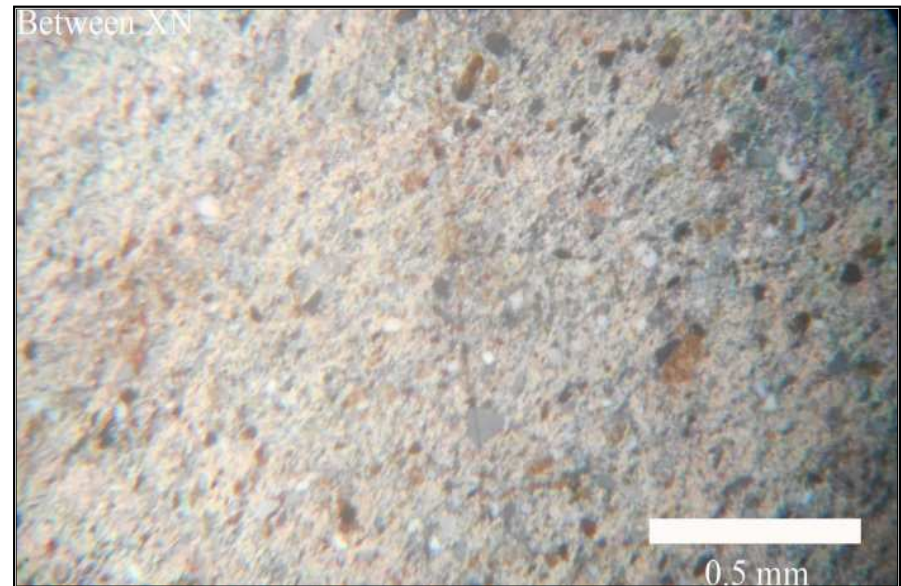
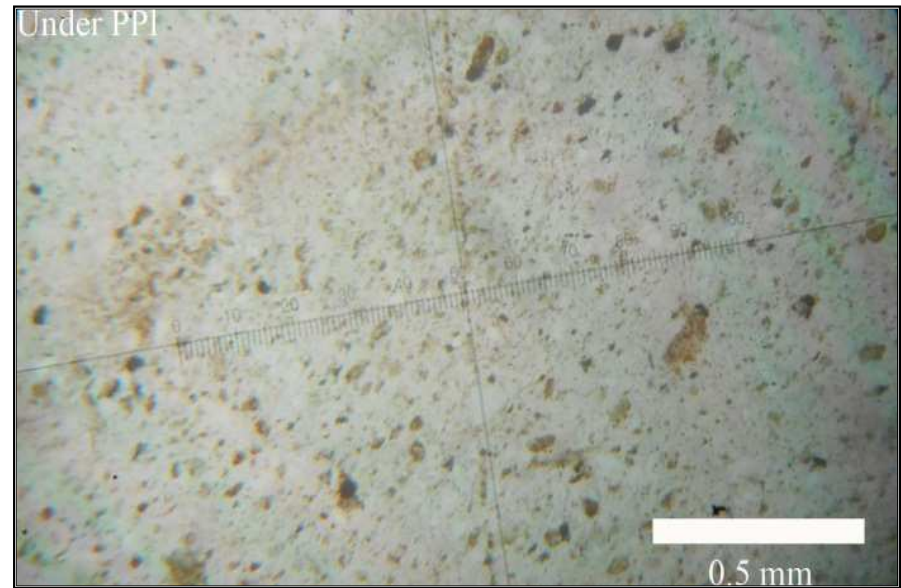


Photomicrograph shows sericite, clay, quartz and opaque specks with roughly parallel alignment of slate .

4.2 Mergui Group

4.2.2 Mudstone

- * Consists mainly of finely sericite flakes mingle with clayey substances with a few amount of Qtz, iron oxide opaque specks
- * Sericite tends to occur as roughly parallel alignment
- * Silt sized detrital quartz grains are disseminated (angular to subangular)
- * Considered that the rock has been formed by incipient metamorphism of Mudstone

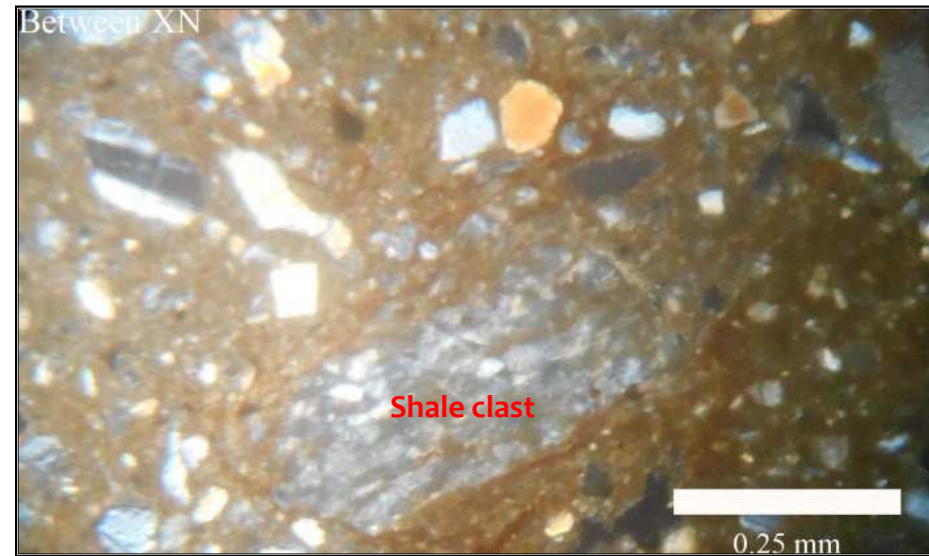


Photomicrograph shows sericite, clay, quartz and opaque specks of mudstone.

4.2 Mergui Group

4.2.3 Pebbly Mudstone

- * Consists of *Quartz, Feldspar and Lithic clast* set in the fine grained argillaceous matrix
- * Qtz froms subangular to subrounded shapes and sizes are variable
- * Feldspars – untwinned orthoclase, twinned plagioclase and a few amount of microcline
- * Lithic clasts are ranging between 0.05 – 4 mm
- * The fine grained matrix is a mixture of fine clay and microcrystalline silica
- * Matrix is stained by brownish coloured hydrous iron



Photomicrograph showing quartz, plagioclase feldspar and shale clast in clayey matrix of pebbly mudstone.

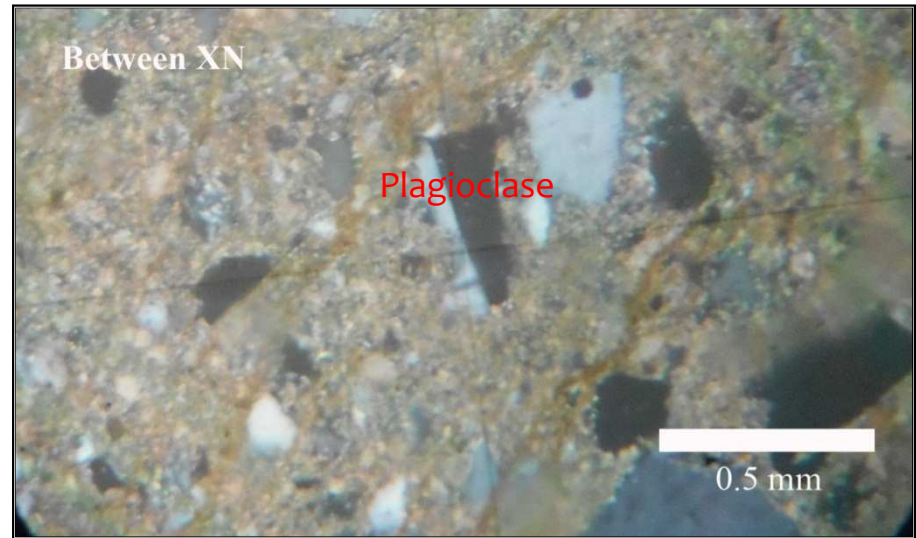


Photomicrograph showing quartz, microcline, lithic clasts and clayey matrix in pebbly mudstone

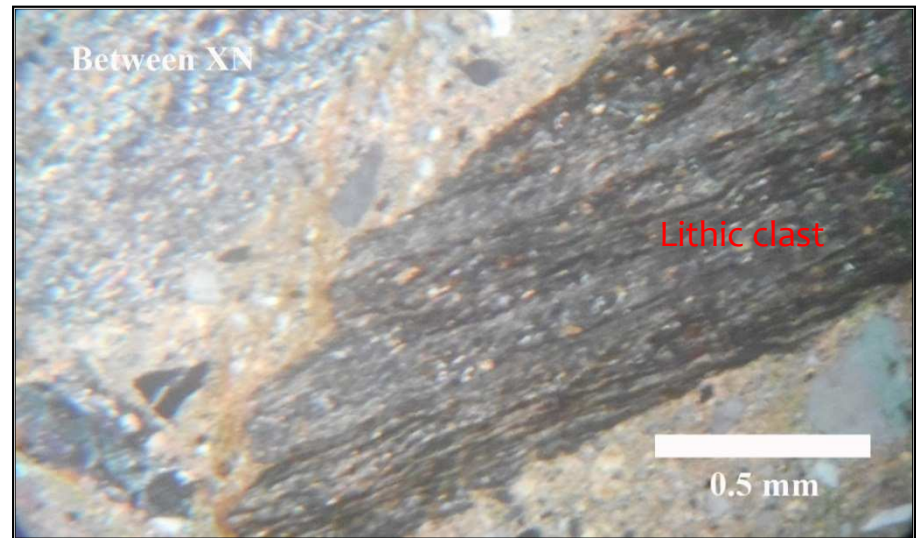
4.2 Mergui Group

4.2.4 Pebbly Sandstone

- * Consists of *quartz, feldspar* and various size of lithic clasts set in the fine grained matrix
- * Quartz forms as subangular to subrounded shapes and variable size
- * Lithic clasts are mostly *quartzite, chert, sandstone, shale* and few *carbonate clast*.
- * Matrix is fine grained mixture of clay, dolomitic carbonate and microcrystalline silica



Photomicrograph showing quartz, plagioclase feldspar and lithic clast (shale) in arenaceous matrix of pebbly sandstone

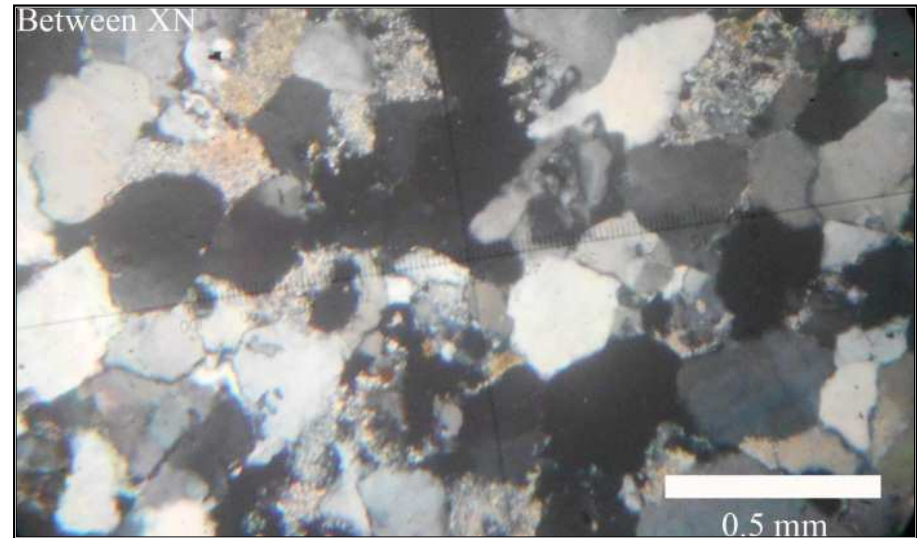


Photomicrograph showing quartz, plagioclase feldspar and the lithic clasts of shale in arenaceous matrix of pebbly sandstone.

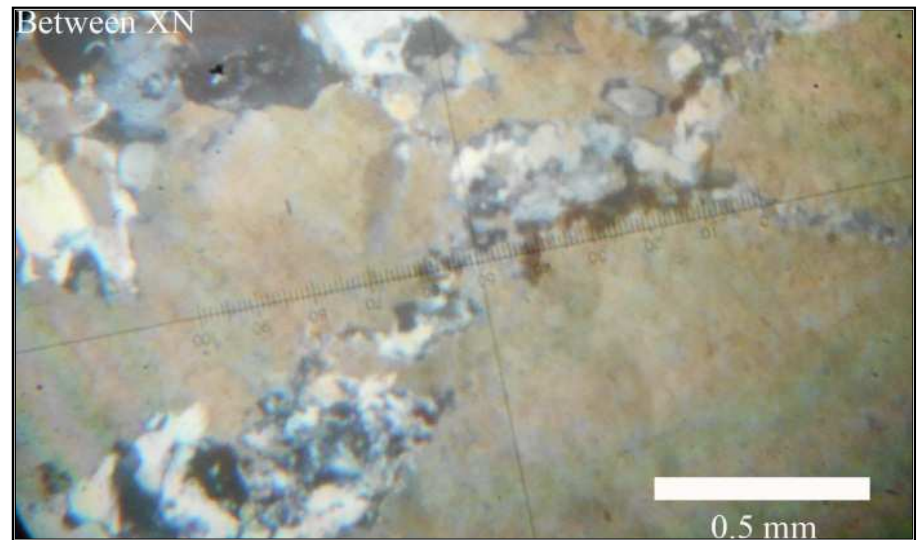
4.2 Mergui Group

4.2.4 Quartzose Sandstone

- * Consists mainly of *Qtz*, *Feldspar* and *lithic clasts* forming a mosaic
- * Subangular to subrounded shapes (0.4 mm)
- * Lithic clasts consists of *chert* and *sericitic clay*
- * Feldspar consists of *microcline*, *orthoclase* and *plagioclase*
- * Barite veins and irregular shaped qtz grains are also detected.



Photomicrograph showing sub angular to subrounded quartz, lithic clasts of chert and sericitic clay in sandstone

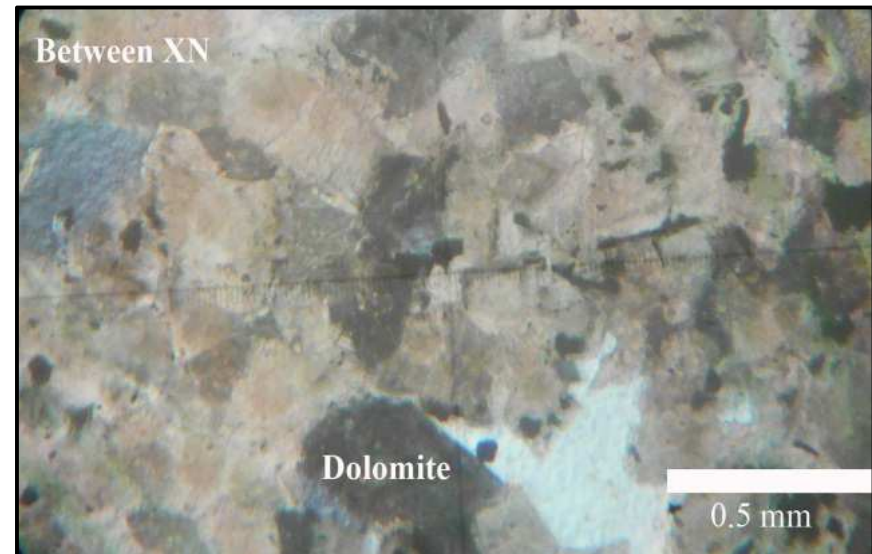
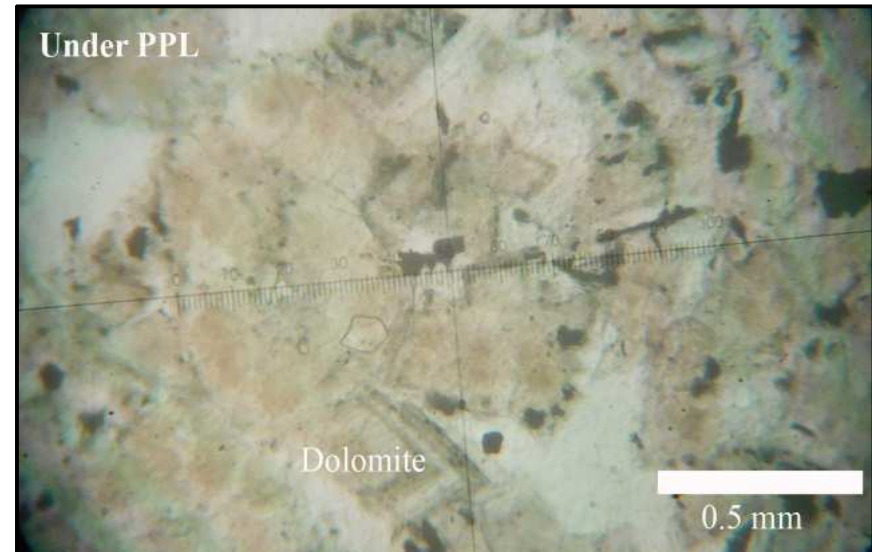


Photomicrograph showing quartz vein in sandstone.

4.2 Mergui Group

4.2.5 Dolomite

- * Consists mainly of fine grained aggregate of calcite mosaic intergrown with dolomite and some detrital quartz.
- * Calcite – *anhedral* crystal
- * Dolomite – Rhomb shaped (*anhedral to subhedral*)
- * Quartz - *anhedral* aggregate grains
- * Opaque - *Galena*

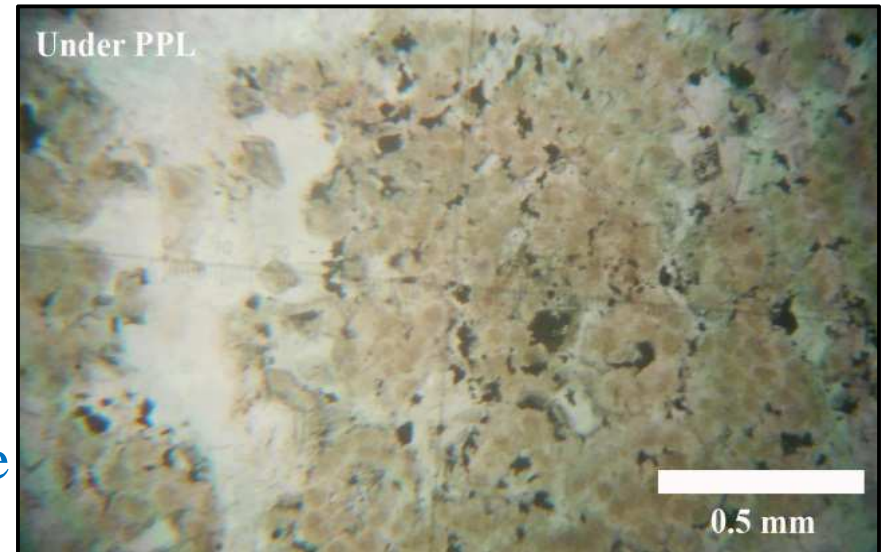


Photomicrograph showing anhedral to subhedral grains of dolomite

4.2 Mergui Group

4.2.6 Limestone

- * Entirely composed of fine grained calcite mosaic with reddish brown coloured hydrous iron oxide stained calcite veinlets
- * Transected calcite veins – 0.2 to 1 mm

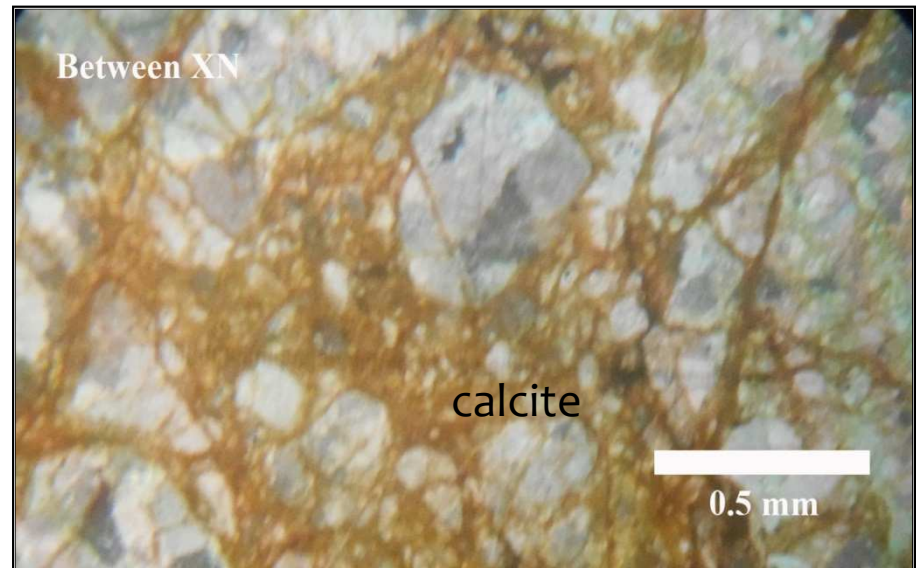
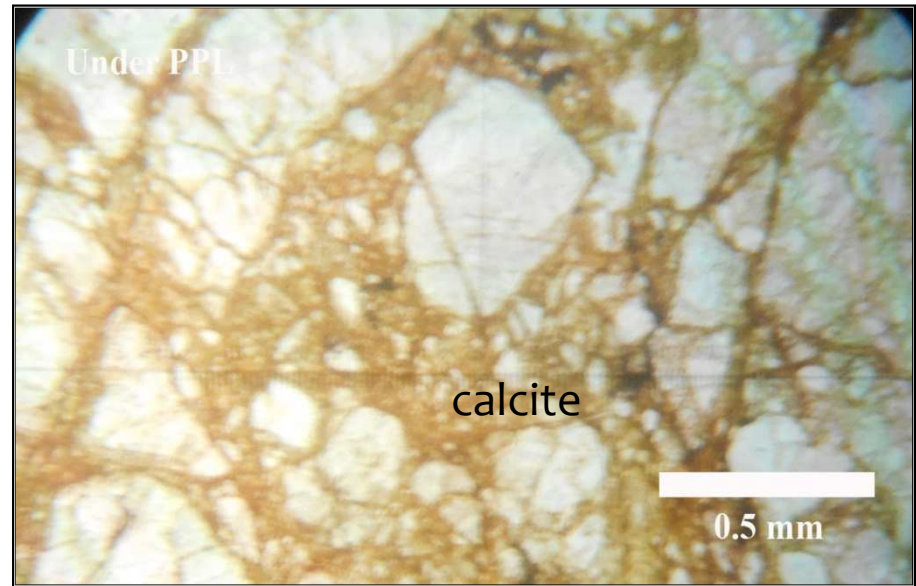


Photomicrograph showing fine grained calcite mosaic with calcite veinlet in limestone.

4.2 Mergui Group

4.2.7 Brecciated Limestone

- * Composed variable sized of subangular to subrounded calcite grains which are *highly brecciated*
- * Yellowish to reddish brown coloured hydrous iron oxide materials are densely filled especially along the fracture due to brecciation
- * Some opaque speck may be galena
- * Calcite shows twinkling effect

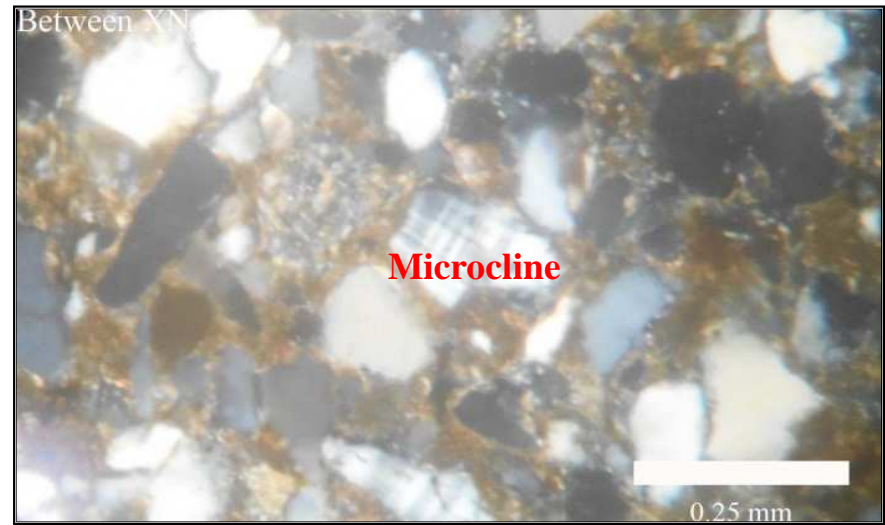


Photomicrograph showing subangular to subrounded calcite fragments set in yellowish brown coloured ferruginous and calcareous matrix in brecciated limestone

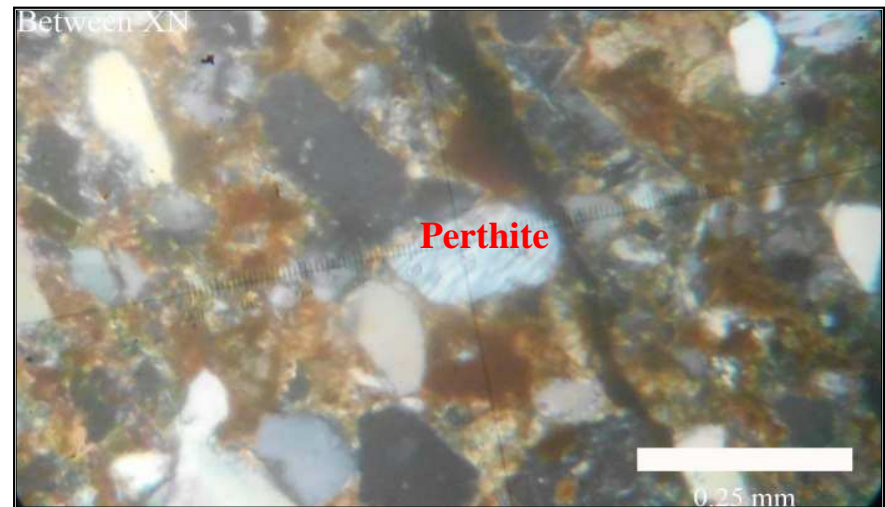
4.3 Kyaukhsu Taung Formation

4.3.1 Sandstone

- * Consist of granular mosaic of *quartz, feldspar, lithic clast and carbonate clasts*
- * *Angular to subangular* shapes (up to 0.3 mm)
- * The *matrix* is *sericitic clay* and *iron oxide*
- * Some iron oxide matrix filled as veinlets, irregular patches



Photomicrograph showing angular to subangular quartz, microcline and lithic clast of chert in ferruginous matrix of sandstone.

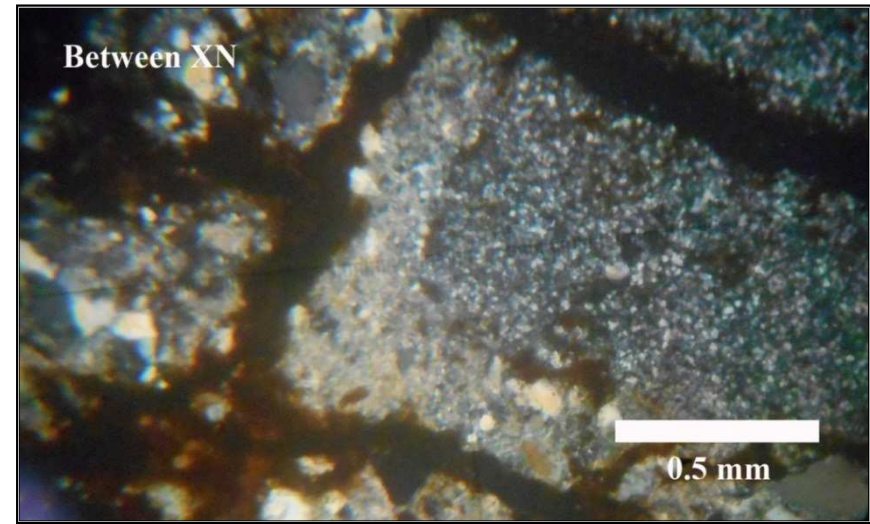


Photomicrograph showing angular to subangular quartz, perthite and chert in ferruginous matrix of sandstone. Dark brown to opaque iron oxide are also noticed.

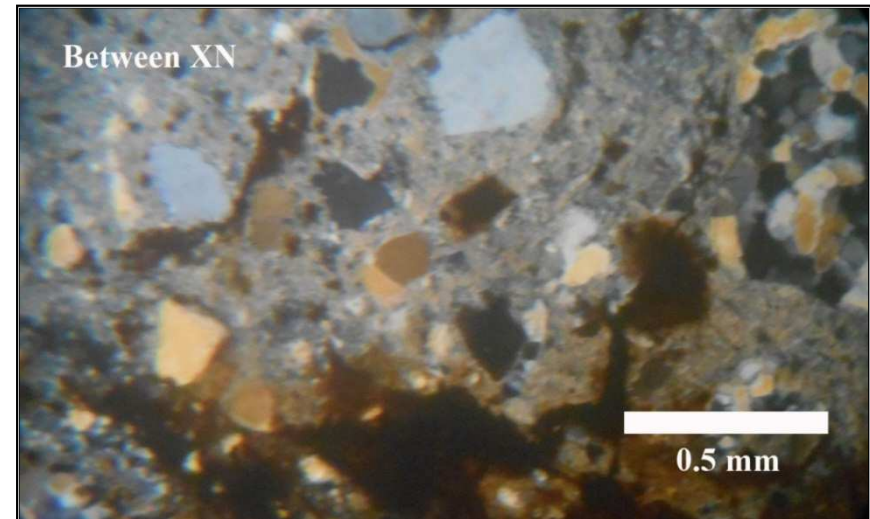
4.3 Kyaukhsu Taung Formation

4.3.2 Brecciated Silicified Sandstone

- * Subangular to subrounded *quartz detrital* (variable grains sized)
- * The matrix is *sericitic clay and iron oxide*
- * *Silicification* is generally common
- * Some *sericitization* are also detected



Photomicrograph cryptocrystalline to microcrystalline silica and dark brown coloured hydrous of iron oxide veinlets in brecciated silicified sandstone

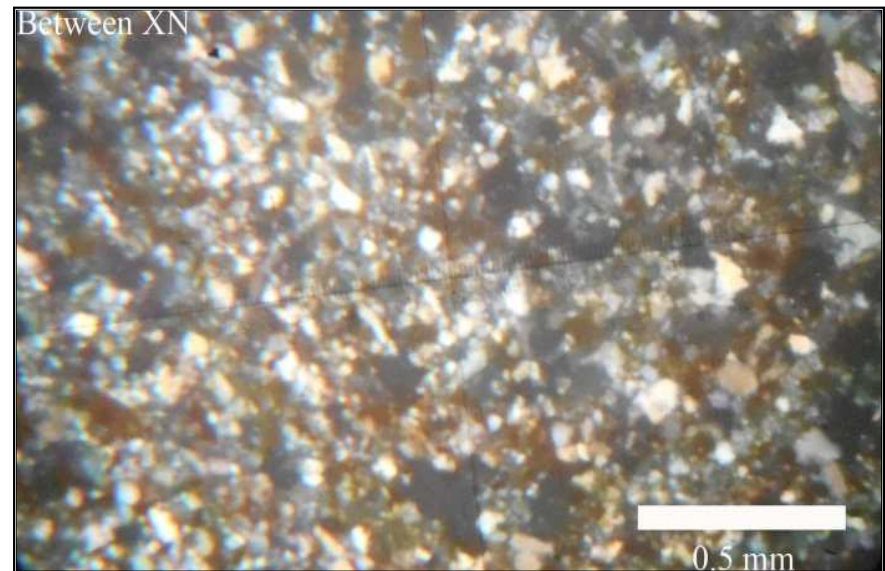
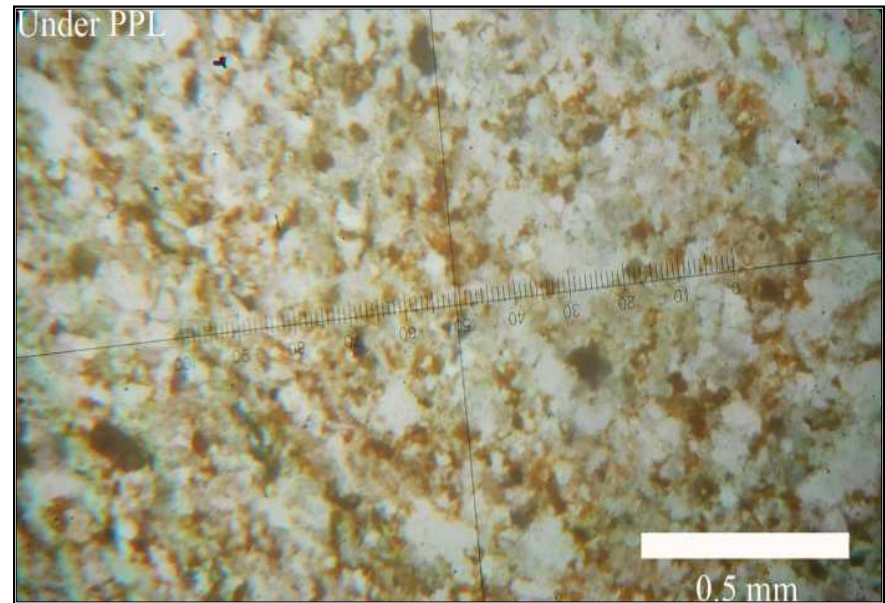


Photomicrograph showing angular to subangular detrital quartz in sericitized and ferruginous matrix of brecciated silicified sandstone.

4.4 Pyinyaung Formation

4.4.1 Sandstone

- * Consist mainly of a granular *quartz* mosaic, *feldspar* and *lithic clasts*
- * *Feldspar* consist of *plagioclase* of twinned and untwinned feldspar
- * Some *feldspar* shows cloudy appearance – **altered to clay**
- * *Lithic clast- chert, sericitic clay* and *ferruginous clay clasts*.
- * *Matrix* between detrital grains consists mainly of *iron oxide stained silicified matrix*

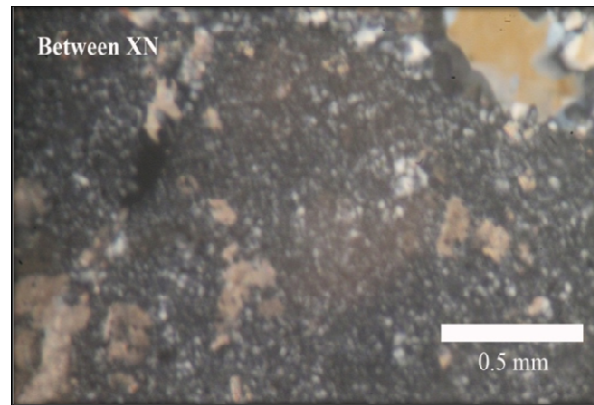


Photomicrograph showing angular to subangular detrital quartz and feldspar in sandstone

ALTERATION

* Based on - *field study & microscopic examination*

Dolomitization



Oxidization



Silicification



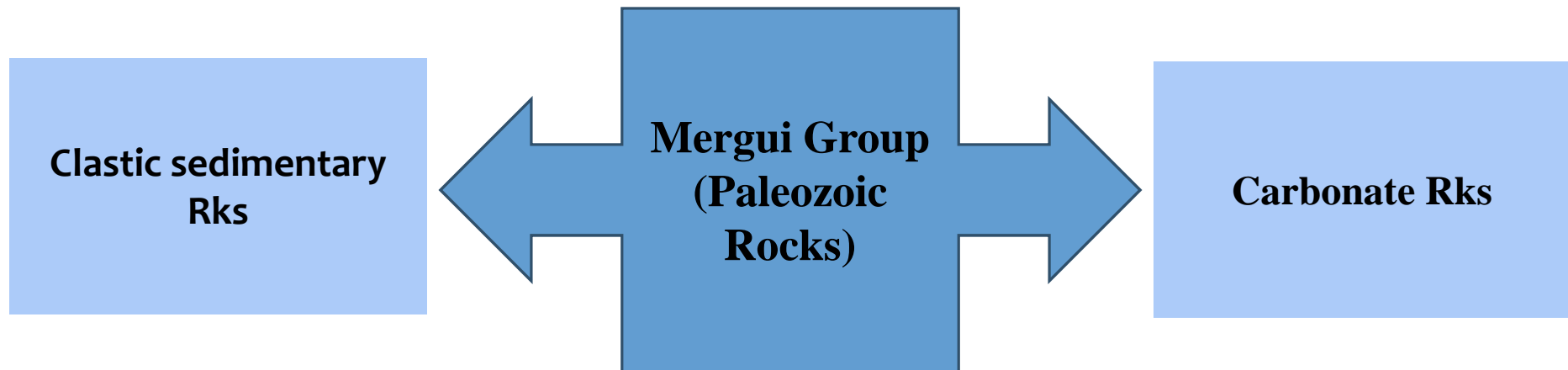
MINERALIZATION

Background History

- * Reports of early geological mapping in the study area were summarized by Chibber (1934)
- * 1976/77 UNDP were follow-up semi-detailed geological mapping and stream sediment GC sampling over an area of 114 sqkm
- * 1986-1991, Soe Thiha et,al(DGSE) was carried out gold exploration at Lebyin-Shweminbon Area
- * 1998-2001 (IMHLE) has done Gold and Antimony exploration in surrounding of the Lebyin area.
- * 2012-2014 Aung Kyaw Moe et,al. (DGSE) was undertaken for minerals exploration at Lebyin _Poklokkale vicinity.

MINERALIZATION

- * The occurrences of lead mineralization are mainly **confined** in the **Paleozoic rocks**
- * Two kinds of **host rocks** – **Mergui Groups** of *clastic sedimentary and carbonate rocks*.
- * All the **occurrences** of barite-galena prospects lie in the **west of Yebu village**.



MINERALIZATION

- * Oxidized silicified breccias of Jurassic rocks are widely distributed on the top of the small hill in the study area
- * According to the (A.A.S) assay result this breccia zone showing a little trace amount of Au, Fe and other elements are present.
- * The location of the occurrences (also called prospect) of barite-galena deposits are –
 - * 1) **Kachinlay work-site**
 - * Location- E 96°24'21" N 20°41'09"
 - * 2) **Sinthe Myaung galena occurrence**
 - * Location- E 96°23'48" N 20°45'50"
 - * 3) **Sinthe Myaung (Extension) galena occurrence**
 - * Location- E 96°23'49" N 20°43'02"



Panoramic view of the oxidized silicified breccia zone
96°23'45" N 20°43'31", Facing - 150°

Kachinlay Work-site

- * Located at E 96 ° 24' 21'' N 20 ° 41' 09''
- * 2.5 km far from west of Yebu village (near Pokloke stream junction)
- * Known as an *old mine* (work- site)
- * There are *two adits* and *two shafts*
- * *Adits* are abandoned
- * *Shafts* are **still exploration** but not economically significance
- * **Galena** is often *associated with barite*

Kachinlay Work-site

- * **Mineralization** is hosted in grey to dark grey coloured *dolomitic limestone*
- * Trending NW-SE and **exposed** as massive *lenses shape*
- * Upper portion – yellowish brown to grey coloured pebbly mudstone, reddish to chocolate brown coloured calcareous sandstone
- * They are trending NW-SE and dipping about 30°- 40° east and west respectively because of complex structure
- * **Galena mineralization** is mostly **observed** along the nearly N-S trending fracture and shear plane of the dolomitic limestone unit.
- * Mineralization is found **associated** with the fault *brecciation zone*
- * *Malachite and Azurite* are also found in *oxidation part*
- * **After DGSE** _Two prospects for Kachinlay work-site:
 - (a) Kachinlay Galena Prospect (A)
 - (b) Kachinlay Galena Prospect (B).

Kachinlay Work-site



Loc. N 20° 41' 13" E 96° 24' 18", Facing - 150°



Loc. N 20° 41' 13" E 96° 24' 18", Facing - 340°

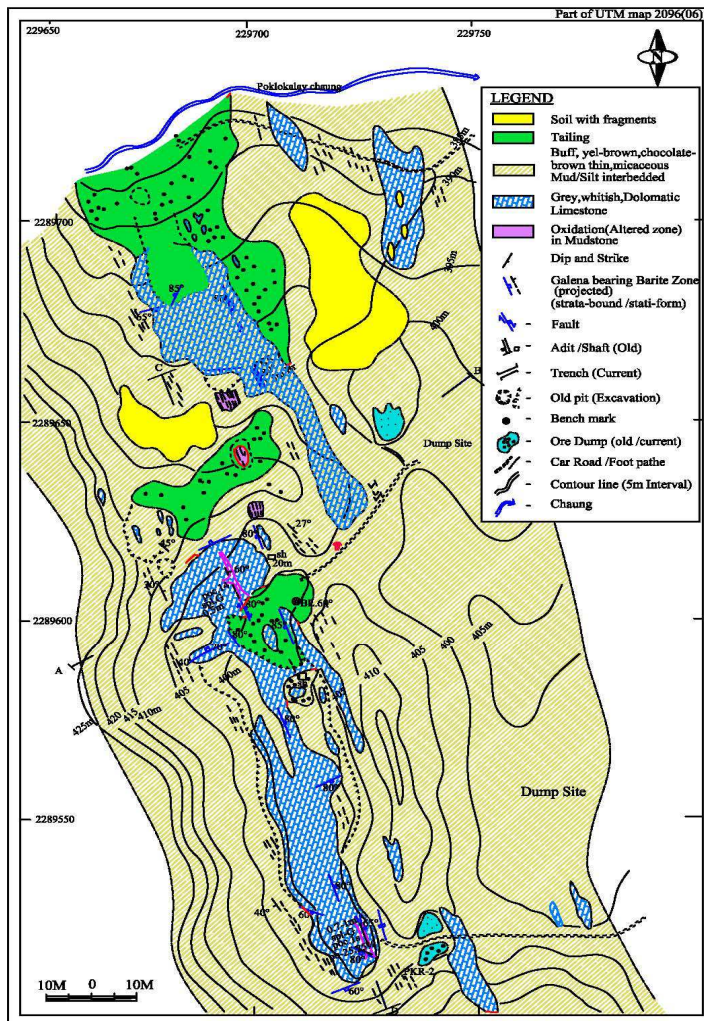


Loc. N 20° 41' 09" E 96° 24' 21", Facing- East

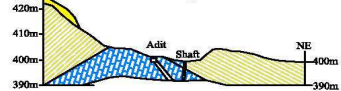


Loc. N 20° 43' 02" E 96° 23' 49", Facing - 330°

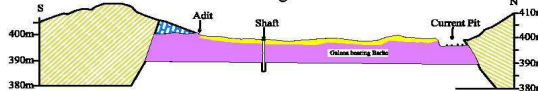
Detailed Geological Map of Kachinlay Galena Prospect (A)



Cross Section Along A to B Looking NW

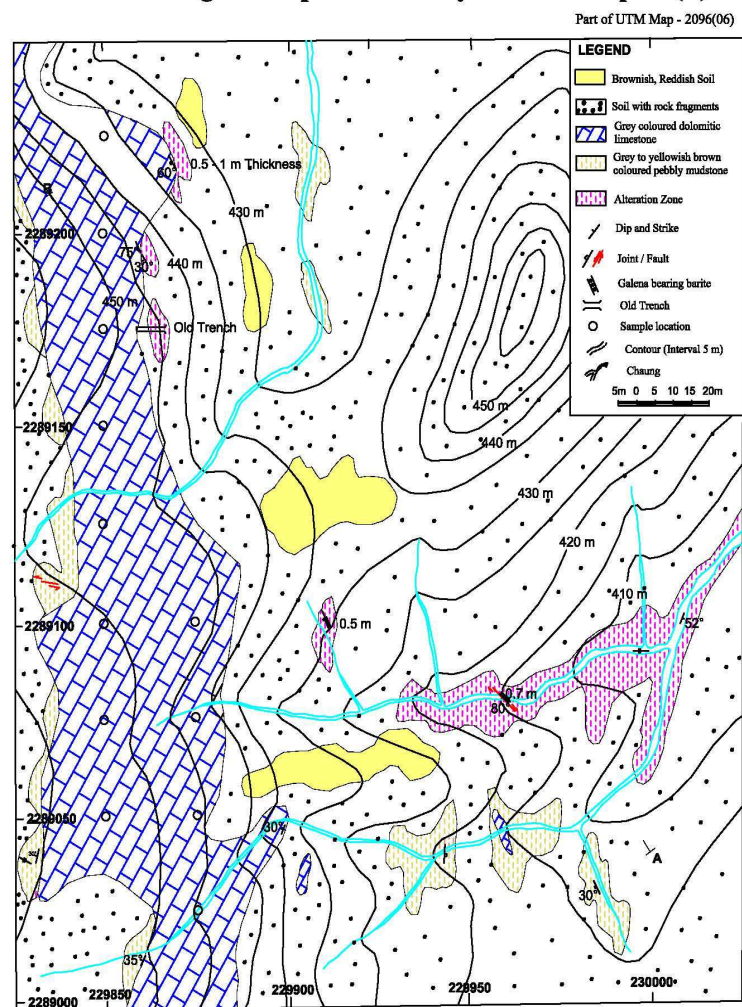


Cross Section Along C to D Looking East

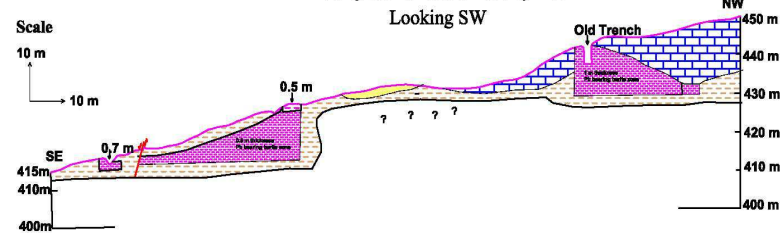


After DGSE

Detailed Geological Map of Kachinlay Galena Prospect (B)



Longitudinal section along A to B



Sinthe Myaung Galena Occurrence

- * Located at E 96 ° 24' 21'' N 20 ° 41' 09''
- * About 3.5 km NW of Yebu village
- * **Hosted** in yellowish brown coloured *pebbly mudstone* of Mergui Group
- * *Barite floats* with galena are found near exposure
- * Tending N-S and dipping due west 50°
- * *Thickness* – **0.15 m**
- * Especially *structural control*
- * The **vein** was *transected by dextral strike-slip fault* which is displaced and occurred at the another side of the stream



Loc. N 20° 43' 50" E 96° 23' 48", Facing – South



Loc. N 20° 42' 50" E 96° 23' 47", Facing – South

Sinthe Myaung Galena Occurrence

- * Near the surrounding area of Sinthe occurrence
- * @ E 96 ° 23' 44" N 20 ° 43' 00"
(*Near Sinthe Occurrence*)
- * Exposed 1 foot / *0.3 m thickness* of galena bearing barite vein
- * It trends NNW-SSE and dipping 35° W
- * **Host rock-** yellowish brown coloured *pebbly mudstone*



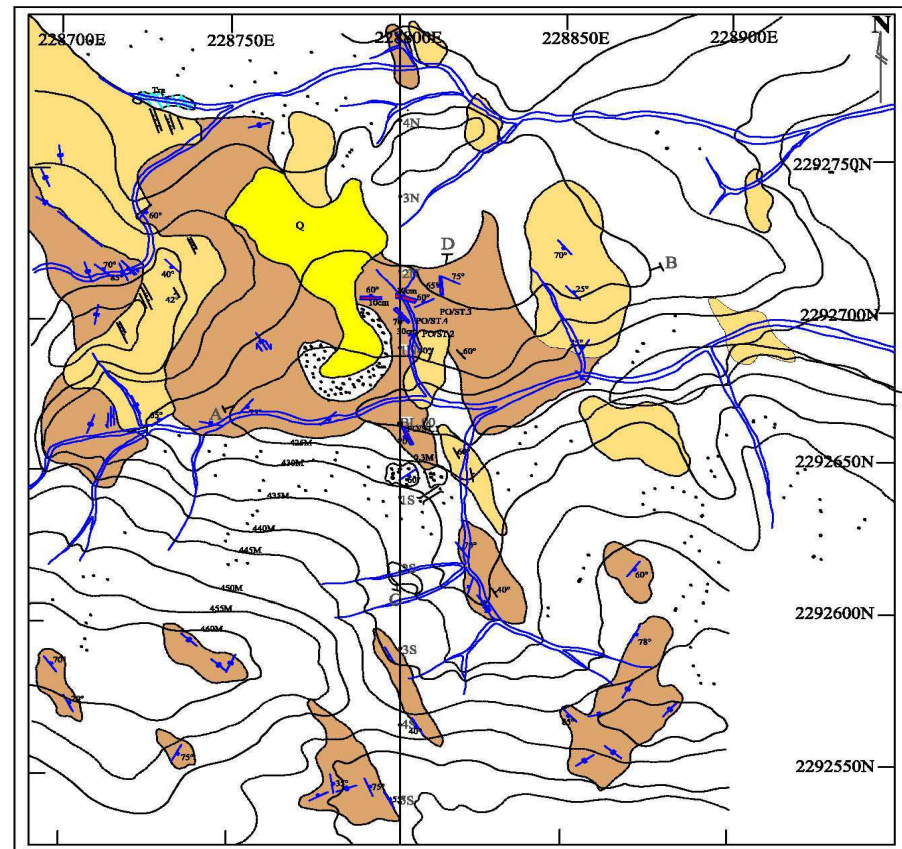
Loc. N 20° 43' 00" E 96° 23' 44", Facing - 205°



Loc. N 20° 43' 00" E 96° 23' 44"

Detailed Geological Map of Sinthe Myaung Galena Prospect

Part of UTM Map Sheet 2096(06)



LEGEND

Q Brown Soil

Travertine

Soil with rock fragments

Grey coloured pebbly mudstone

Dark grey coloured mudstone & pinkish siltstone

70° Dip and Strike

40° Joint/ Fault

Galena bearing Barite

lithologic contact

BL.00 Bench Mark (228800E/2292665N)

Contour (Interval 5m)

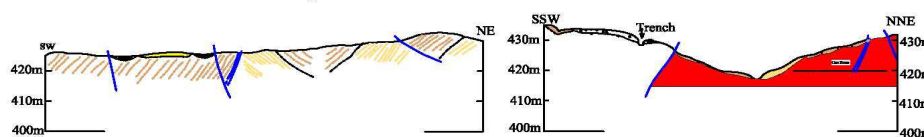
Trench

Chaung

10M
10M

Cross section along A to B

Longitudinal section along C to D



After DGSE

Sinthe Myaung (Extension) galena Occurrence

- * **Found** at the northern part of Sinthe Myaung galena occurrence
- * Located at E 96° 23' 49" N 20° 43' 02"
- * **Mineralization** *hosted* in grey coloured *dolomitic limestone*
- * **Trending** nearly N-S and exposed as massive small scattered outcrop



Loc. N 20° 43' 02" E 96° 23' 49", Facing - 152°

Sinthe Myaung (Extension) galena occurrence

- * Yellowish, reddish to chocolate brown coloured calcareous sandstone and silicified brecciated sandstone are also detected by trenching
- * Therefore, this occurrence is mostly similar Kachinlay work-site
- * But the exposure of the host rock is quite small
- * Mineralization is *poor* when compare with the Kachinlay work-site



Loc. N 20° 43' 02" E 96° 23' 49"



Loc. N 20° 43' 02" E 96° 23' 49", Facing – NW

Sinthe Myaung (Extension) galena occurrence

- * **Southern continuation** of the *occurrence* galena bearing barite vein
- * **Hosted** in yellowish grey to grey coloured **quartzose sandstone**, mostly brecciated due to fault
- * Barite- galena vein **trends NNW-SSE** trending and dip amount is **70° due W**
- * There is a NE-SW trending **minor left-lateral strike-slip fault**
- * **Barite is main** constituent and **galena is the minor** constituent



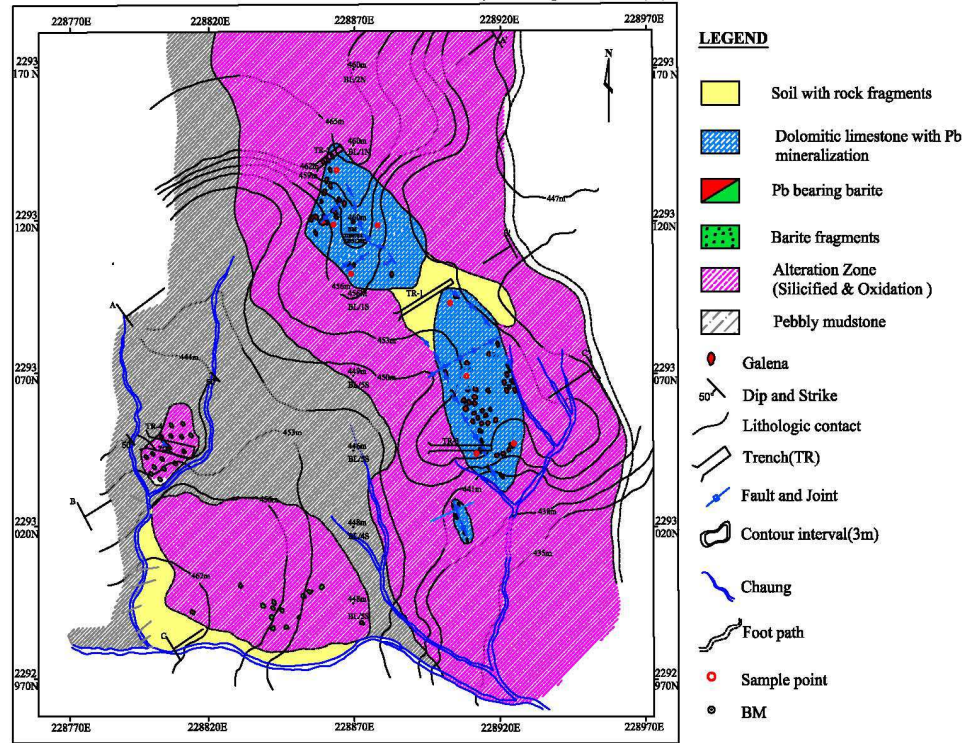
Loc. N 20° 43' 02" E 96° 23' 45", Facing - 60°



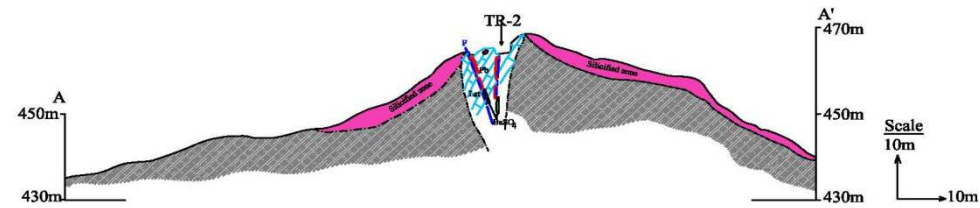
Loc. N 20° 43' 00" E 96° 23' 44", Facing - 240°

Detailed Geological Map of Sinthe Myaung (Extension) Galena Prospect

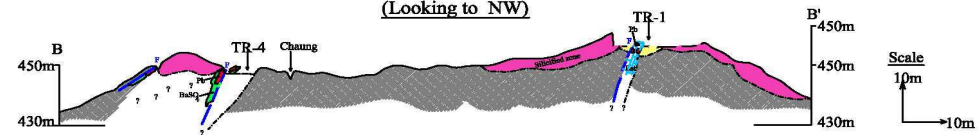
Part of UTM Map Sheet -2096(06)



Cross Section along A to A' (Looking to NW)



Cross Section along B to B' (Looking to NW)



After DGSE

Ore mineralogy of the study area

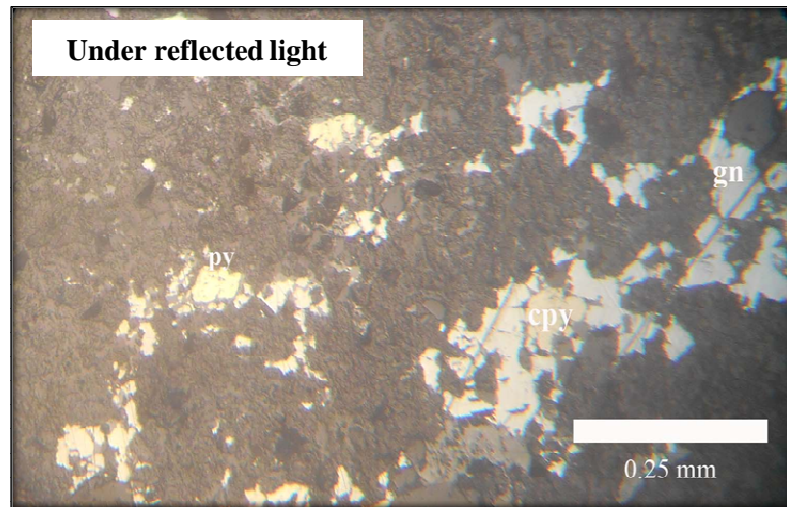
- * **Twelve polish slides** were studied by using ore microscope
- * **Collected** from *four occurrences* of lead mineralization
- * **Especially** *carbonate hosted* and *galena bearing barite veins*

The ore minerals is mainly galena

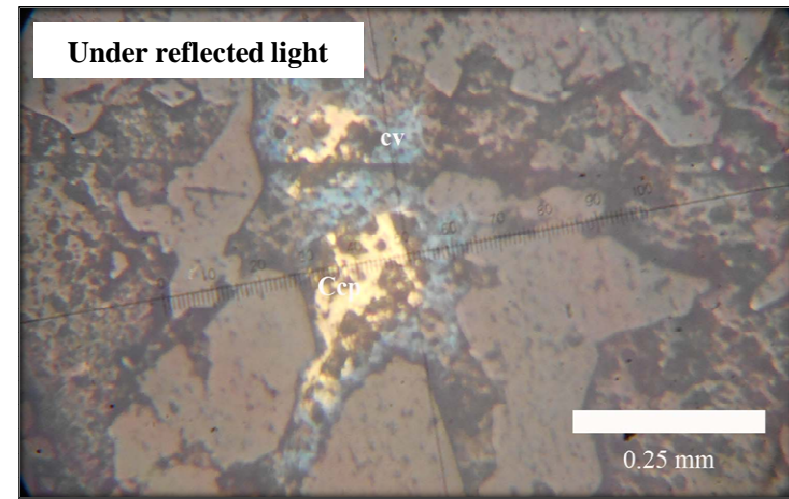
Gangue minerals – *Barite, calcite, dolomite and quartz*

Associate minerals _ *Pyrite, chalcopyrite, covellite, and chalcocite*

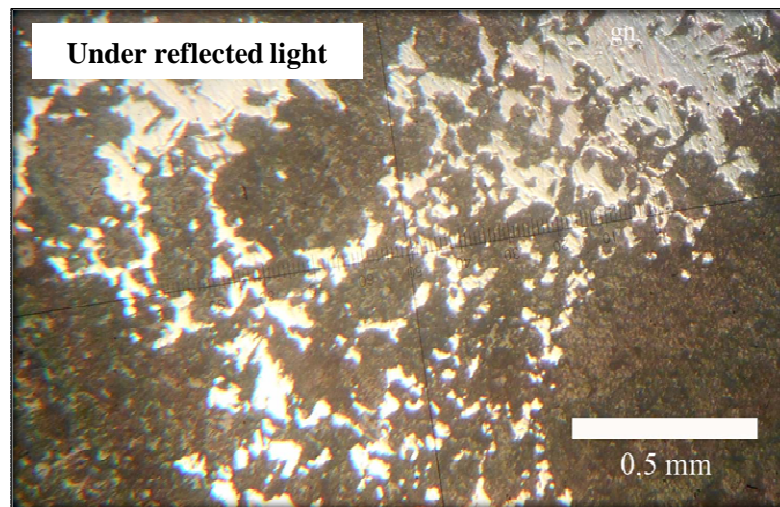




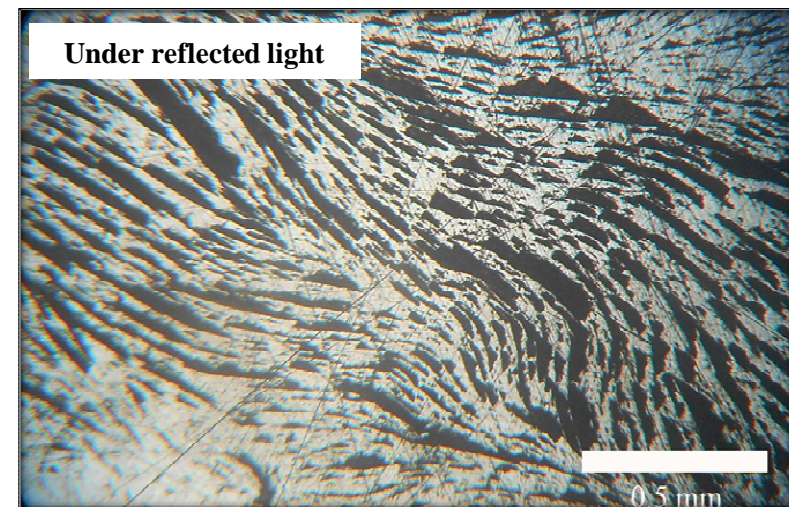
Yellowish white coloured pyrite(py), yellow coloured chalcopyrite associated with white coloured in galena



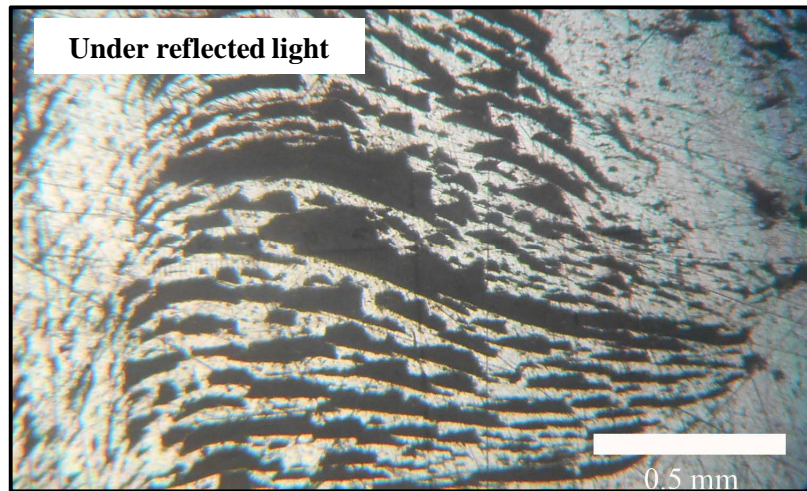
Chalcopyrite (cpx) is partially replaced by covellite (cv)



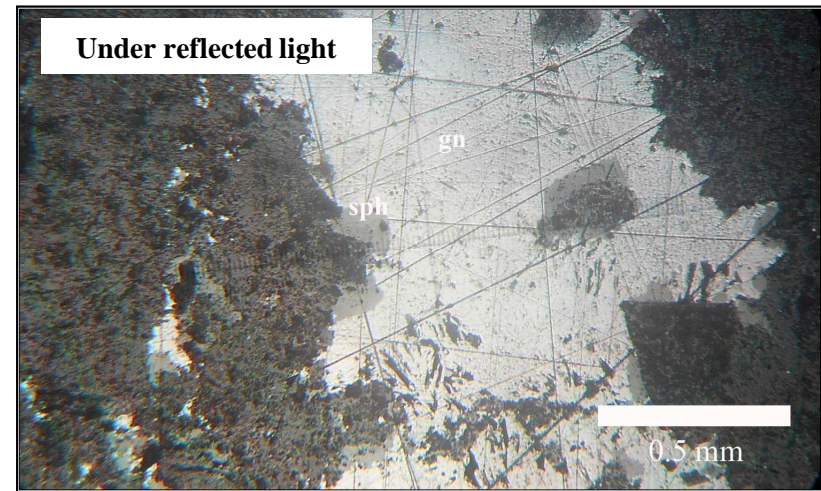
Disseminated galena within gangue minerals



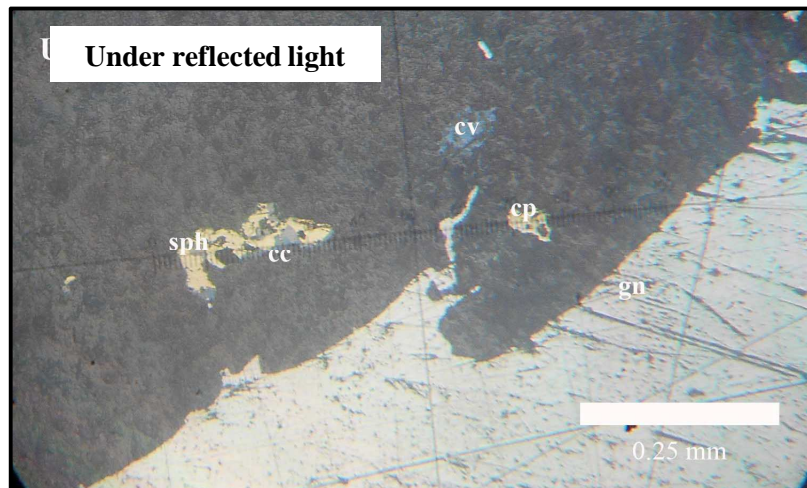
Curved cleavage triangular pits showing that have developed in galena as a result of post-depositional deformation



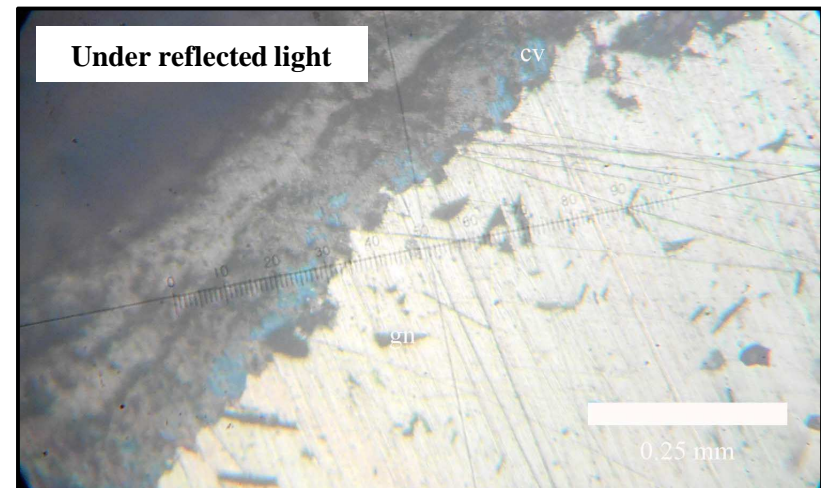
Galena showing triangular pits and the bending of cleavage formed by post depositional deformation.



Photomicrograph of light grey coloured sphalerite (sph) occur in the outer margin of galena (gn)



Bluish coloured chalcocite (cc), covellite (cv), light grey coloured sphalerite (sph) and yellow coloured chalcopyrite (cp) and galena

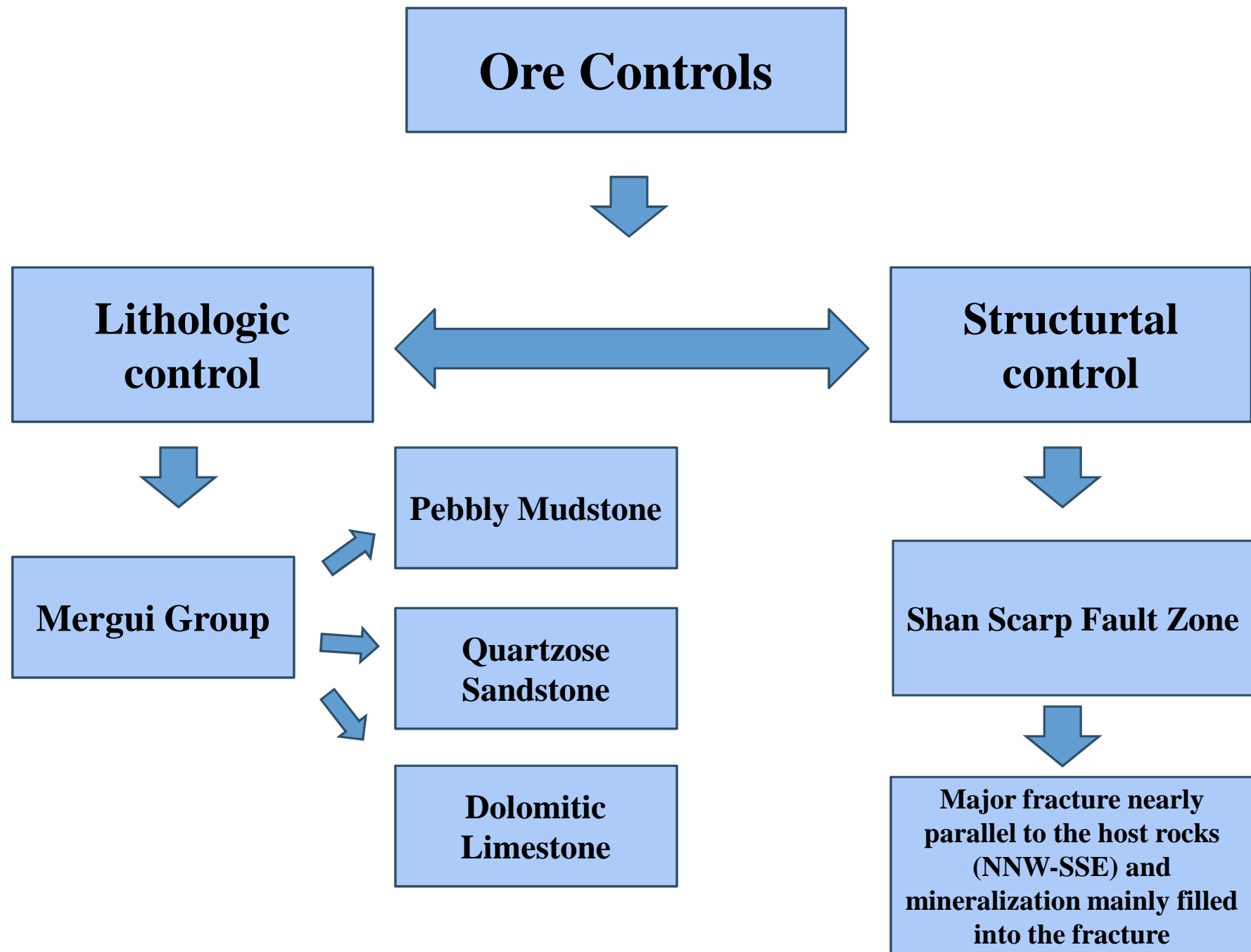


Covellite (cv) occurs along the grain margin of galena (gn).

Paragenetic Sequence

- * **Base upon the ore microscopic study**
- * The minerals identification and its characteristic features are carried out from the galena bearing barite veins and carbonate host
- * According to ore microscopic result, barite and other gangue minerals such as *dolomite and calcite are being formed first*
- * The **early stage mineralization of sulphides**- *pyrite* and *chalcopyrite* , *galena* and *sphalerite*, are from as infilled or disseminated along the fracture and interstices of gangue minerals
- * The **late stage**- secondary minerals such as *chalcocite* and *covellite* are formed by alteration of decomposition of sulphides

Mineral	Stage		
	Early	Middle	Late
Pyrite
Sphalerite
Galena
Chalcopyrite	
Chalcocite	
Covellite	



Possible genesis of lead mineralization

- * Lead mineralization is mainly occurred as *veins and veinlets*
- * Locally *disseminated and overprinted* on the **carbonate rocks**
- * *Dolomitization and silicification* is dominantly observed
- * Silicification is one of the evidence of hydrothermal alteration which *comes from Igneous intrusion*
- * **Diorite intrusion** can be found at *near Lebyin village* at the southern part of the study area
- * This is the *main source for the simulating agent* for mineralization

Possible genesis of lead mineralization

- * **Hydrothermal fluid** - upward through *faults, fractures and contact weak zones*
- * *The fracture is one of the channel ways for ore bearing fluid*
- * Moreover, the occurrence of galena bearing *Qtz float*, galena bearing *barite veins* and *Qtz-barite veins* are the hydrothermal criteria
- * Therefore, **the type of ore deposit may be *hydrothermal origin***
- * According to the observation of lead mineralization in the study area may be **structural related hydrothermal fracture filling deposit**

Possible age of mineralization

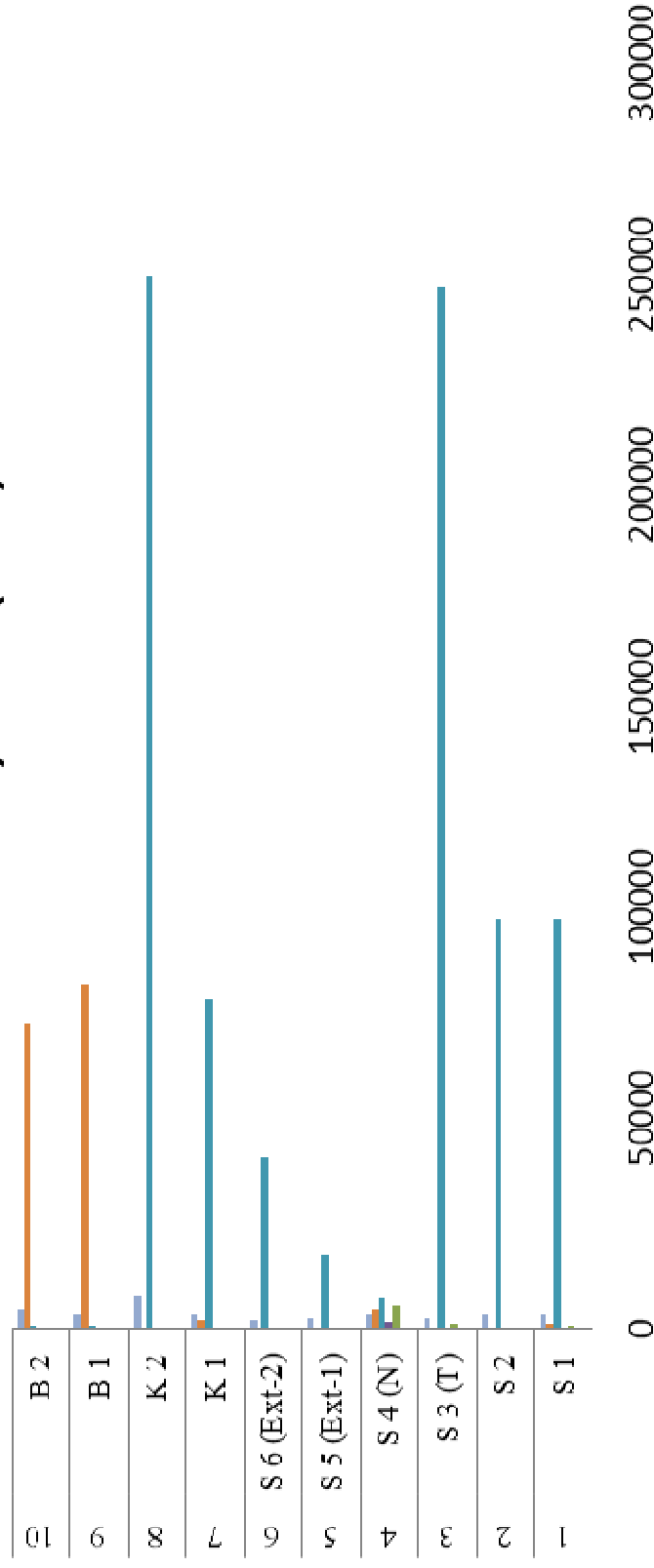
- * The age of lead mineralization of the study area cannot be definitely identified
- * Lead mineralization is *occurred* in rocks of Mergui Group
- * The age of Mergui group is *Upper Carboniferous – Lower Permian*
- * Although , the diorite intrusion is not directly related in the study area but it may be the source of mineralization fluids
- * The age of diorite intrusion may be **Lower Cretaceous?**(IMHL(E) 2004)
- * Regionally, the age of diorite intrusion may be the youngest in the study area
- * Therefore, **the age of lead mineralization is younger than the the age of Lower Cretaceous?**

GEOCHEMICAL INVESTIGATION OF LEAD MINERALIZATION IN THE STUDY AREA

7.1 Geochemical investigation of lead mineralization

- * Ten representative sample were taken from mineralization occurrences
- * These were collected randomly from the occurrences of *galena bearing barite veins , carbonate hosted mineralization and oxidized breccia zone*
- * The elements of Au, Ag, Cu, Zn, Pb, Fe and Sb were detected
- * These samples data analyzed @ **D.G.S.E**

Geochemical Assay Result (A.A.S) of the study area

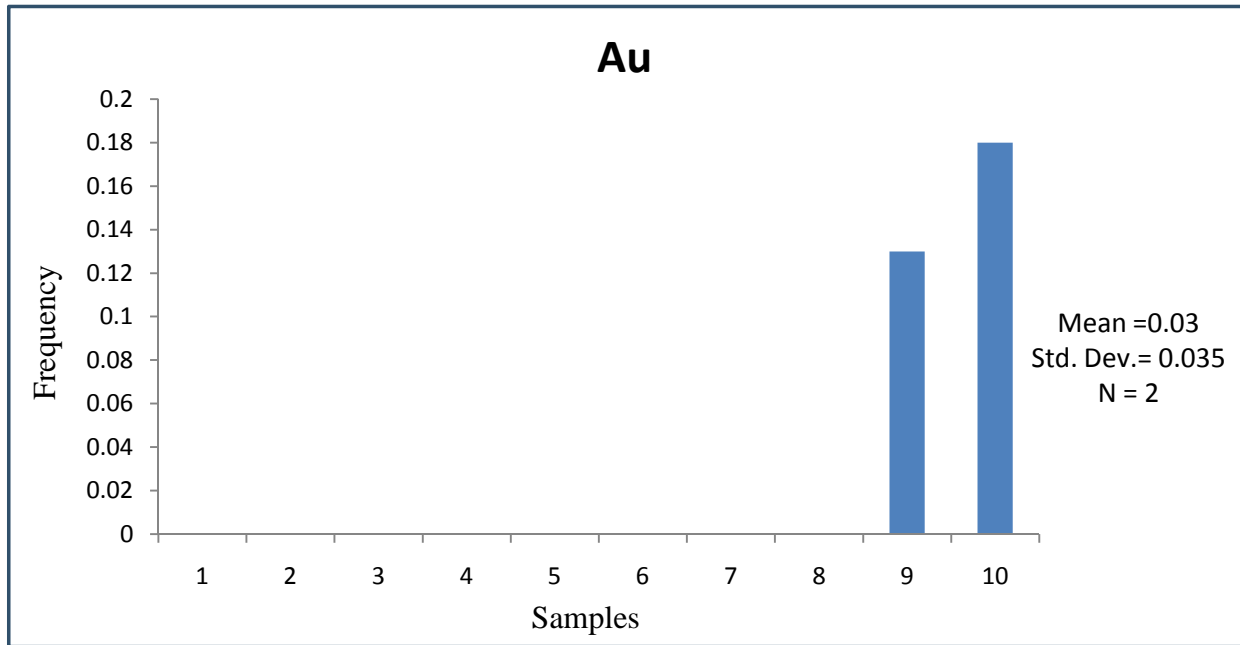
[illegible]

**Mean(x), Standard Deviation(S) and Threshold values (X+2S)
of elements in the study area**

Element (ppm)	Mean(X)	Standard Deviation (S)	Threshold (X+2S)
Au	0.03	0.035	0.10
Ag	20.80	20.81	62.42
Cu	764.30	1640.86	4046.02
Zn	175	432.08	1039.16
Pb	83380	94506.83	272393.66
Fe	16240	31999.90	80239.8
Sb	3490	1585.66	7111.32

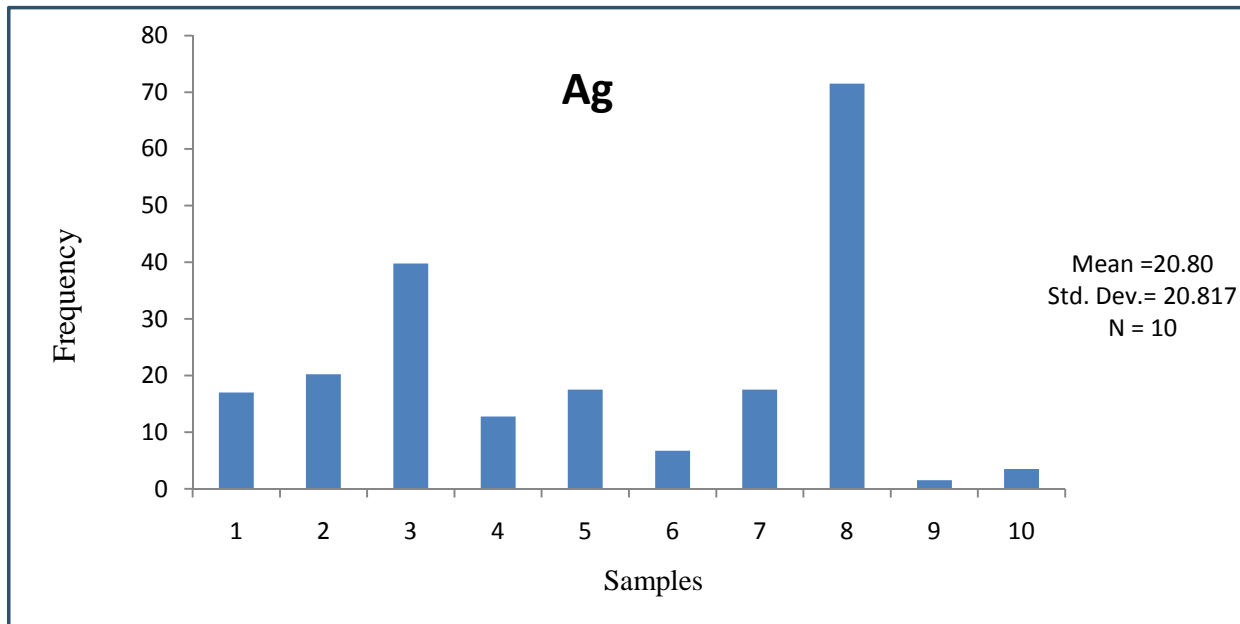
***Samples data obtain geochemical analysts that have been treated by statistical method using Geostatistical software that was done by calculating value**

7.2 Element distribution of the study area



The concentration of gold is ranging from **0 to 0.18 ppm**

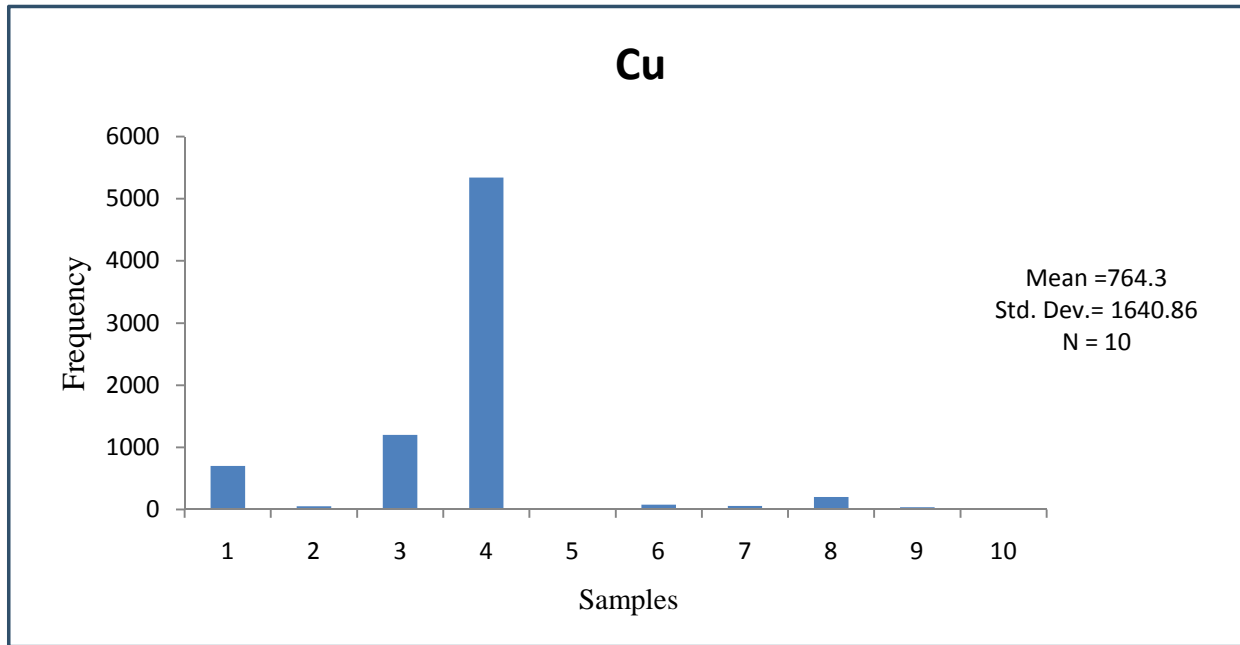
Threshold_0.10 ppm



The concentration of silver is ranging from **1.50 to 71.50 ppm**

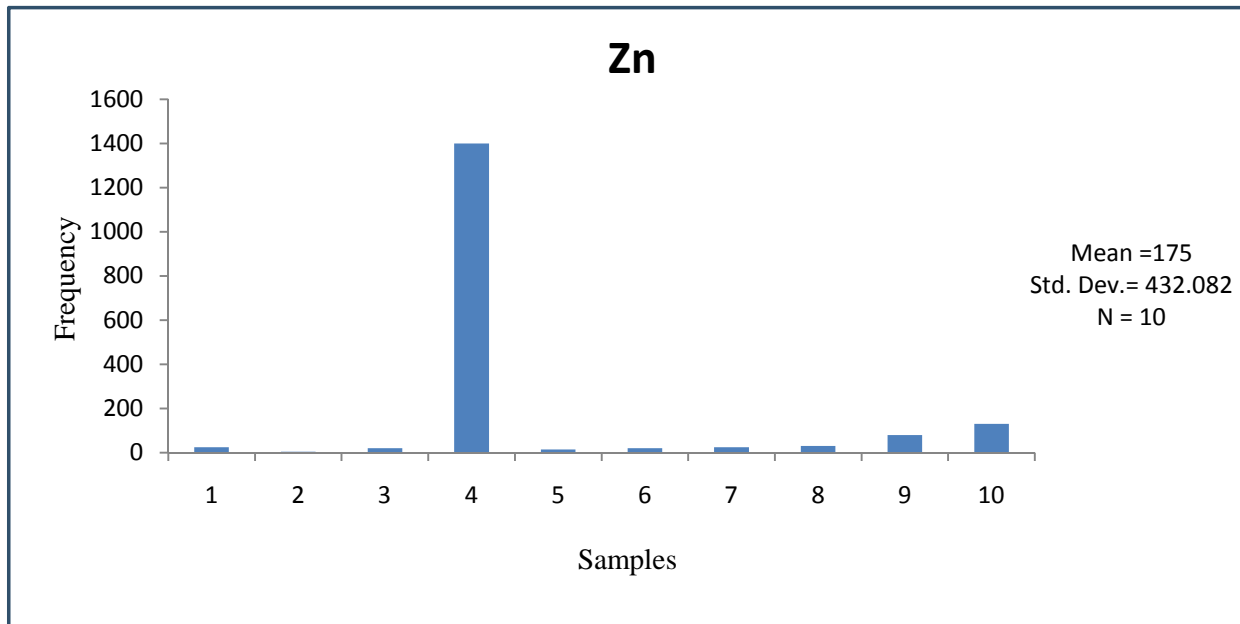
Threshold_62.42 ppm

7.2 Element distribution of the study area



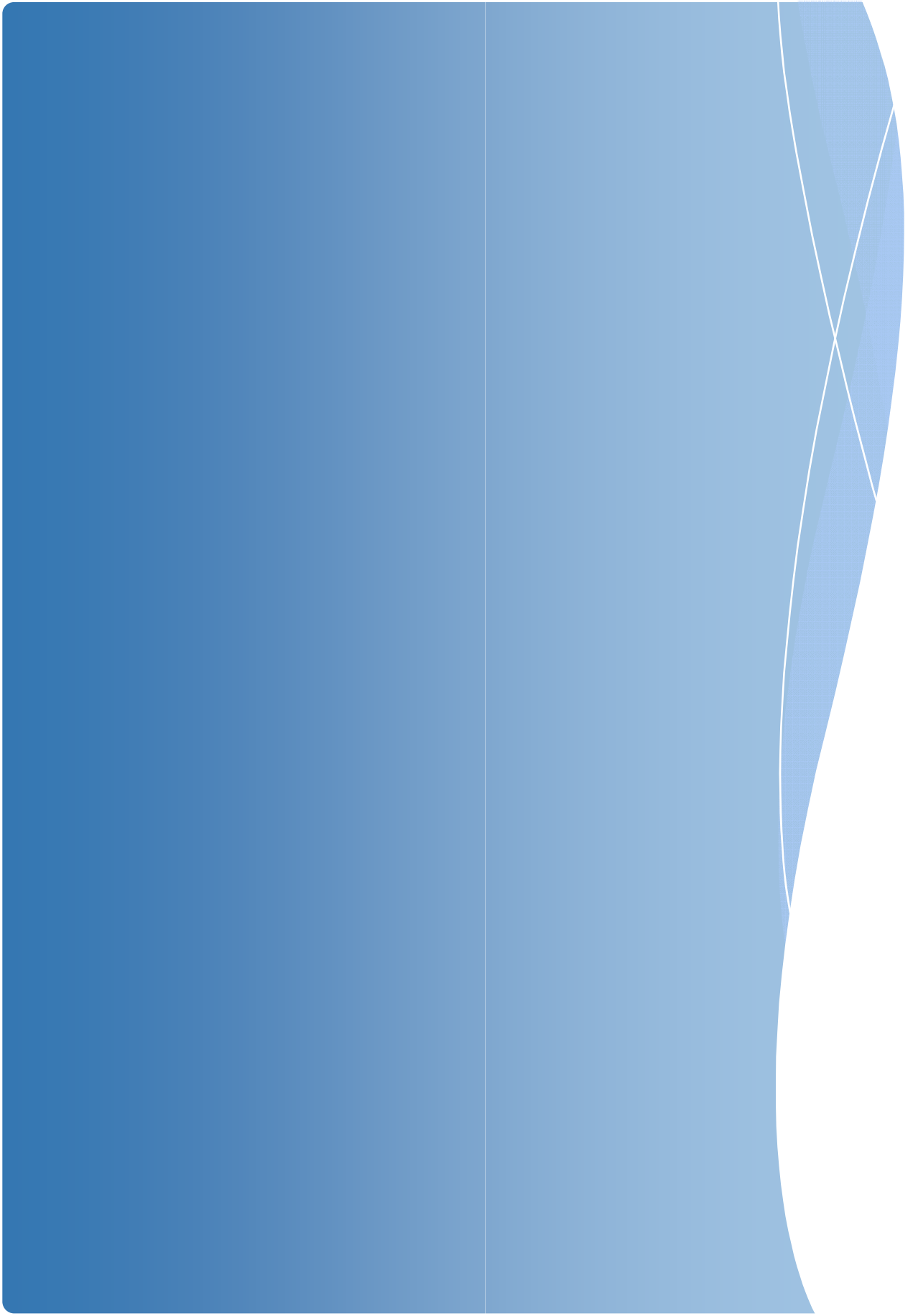
The concentration of copper is ranging from **6 to 5300 ppm**

Threshold_4046.02 ppm

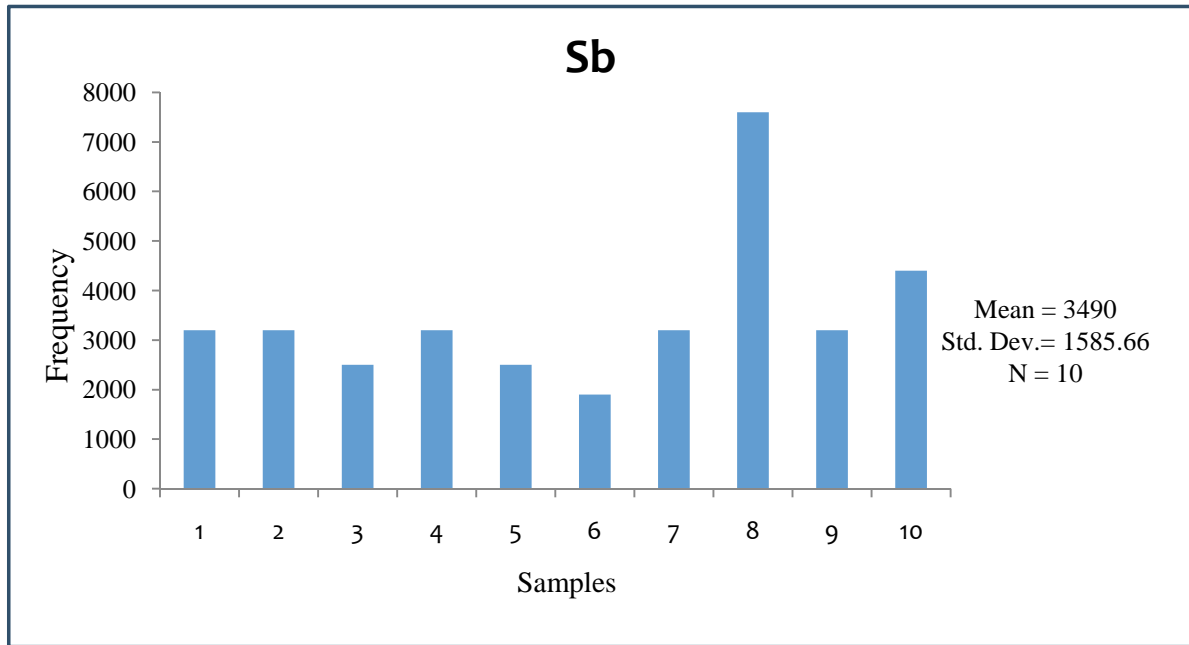


The concentration of zinc is ranging from **5 to 1400 ppm**

Threshold_1039.16 ppm



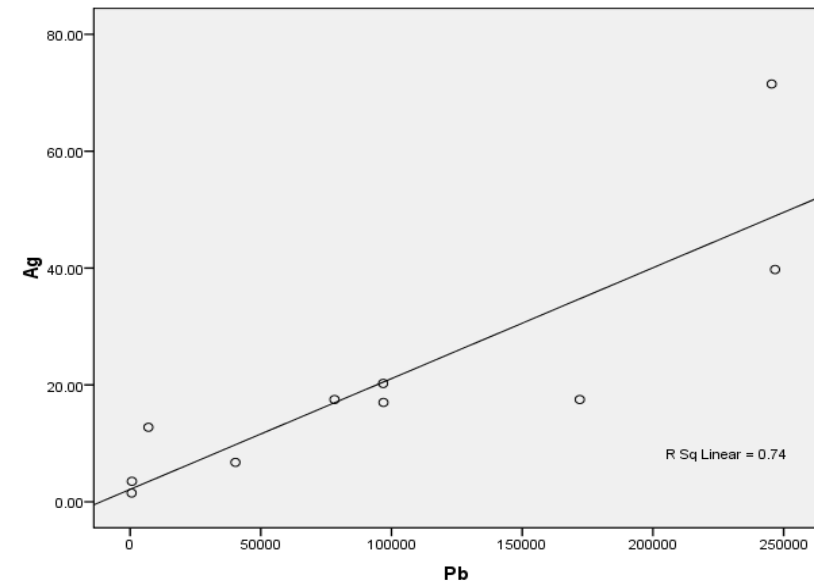
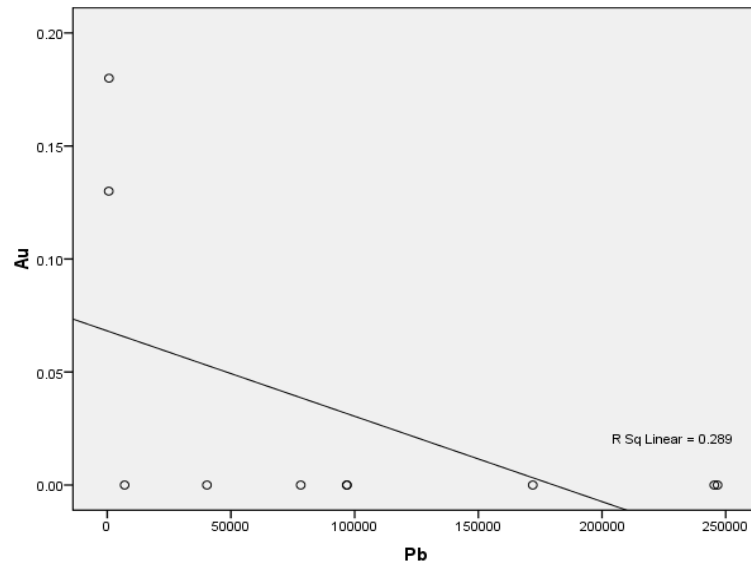
7.2 Element distribution of the study area



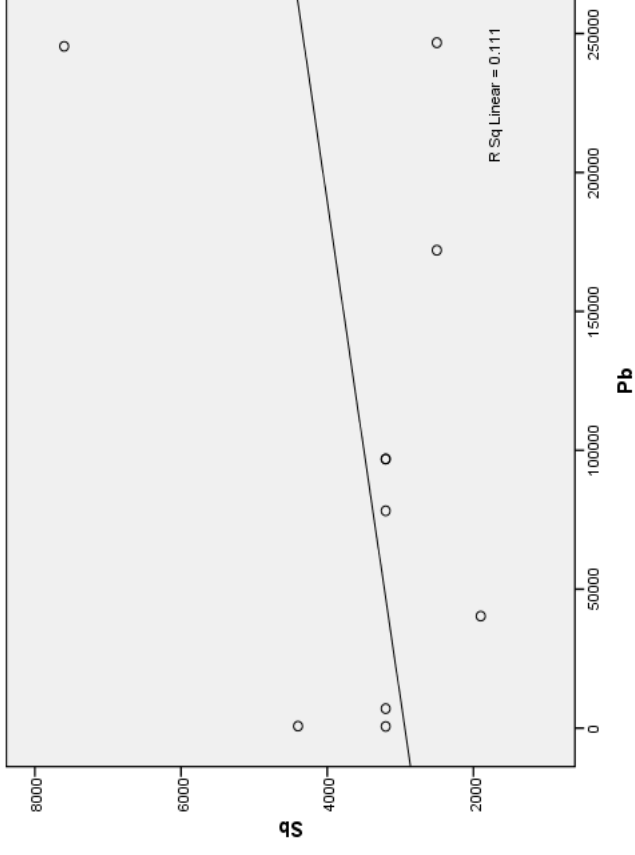
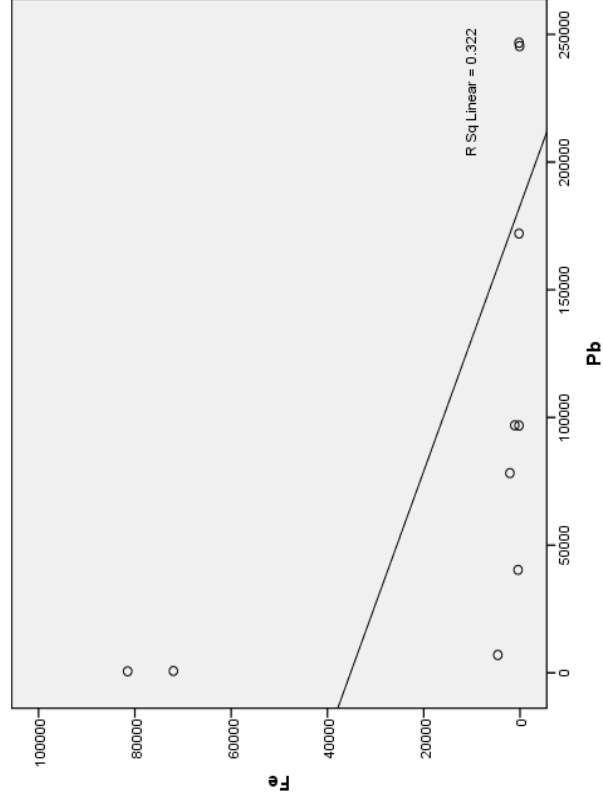
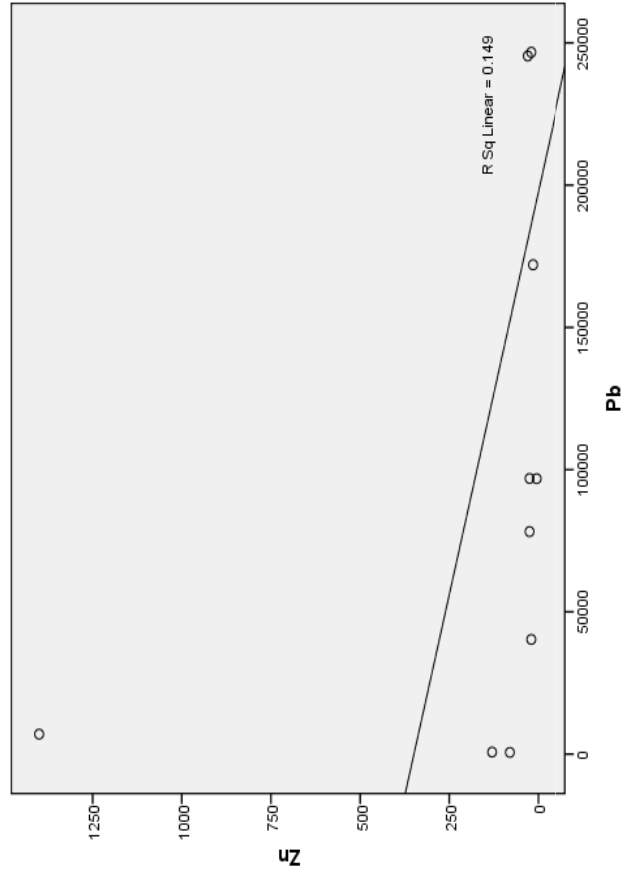
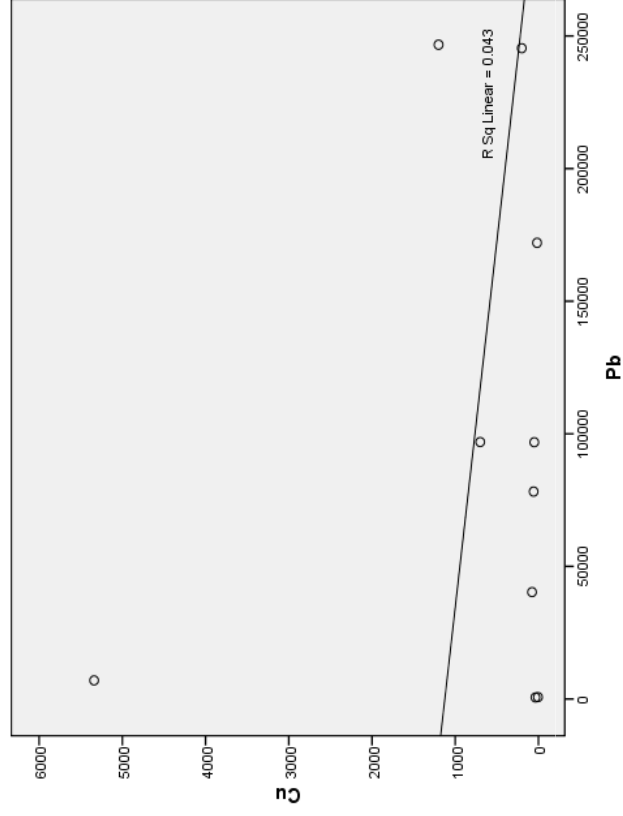
The concentration of antimony is ranging from **1900 to 7600 ppm**

Threshold_7111.32 ppm

Variation Diagram

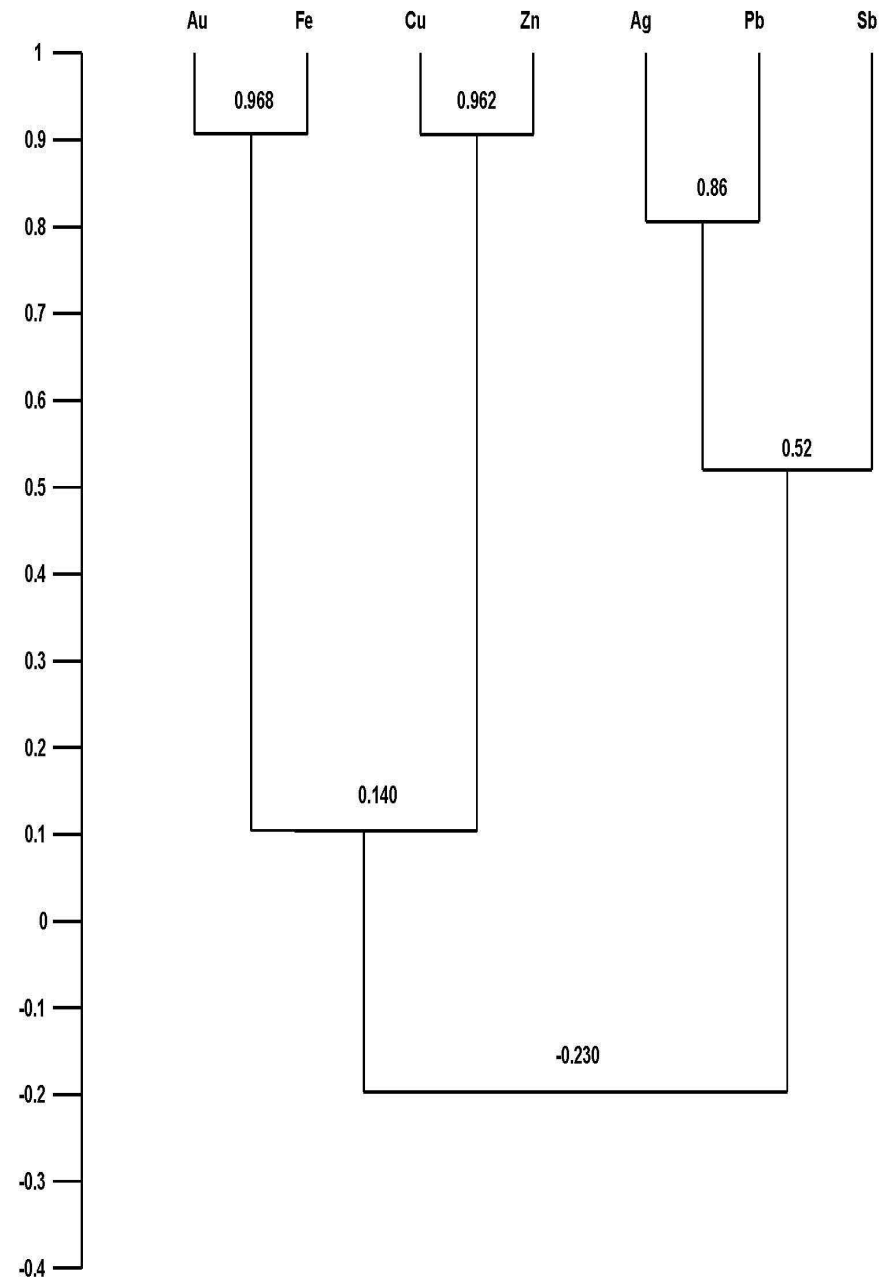


Variation Diagram



7.3 Cluster analysis of samples result in the study area

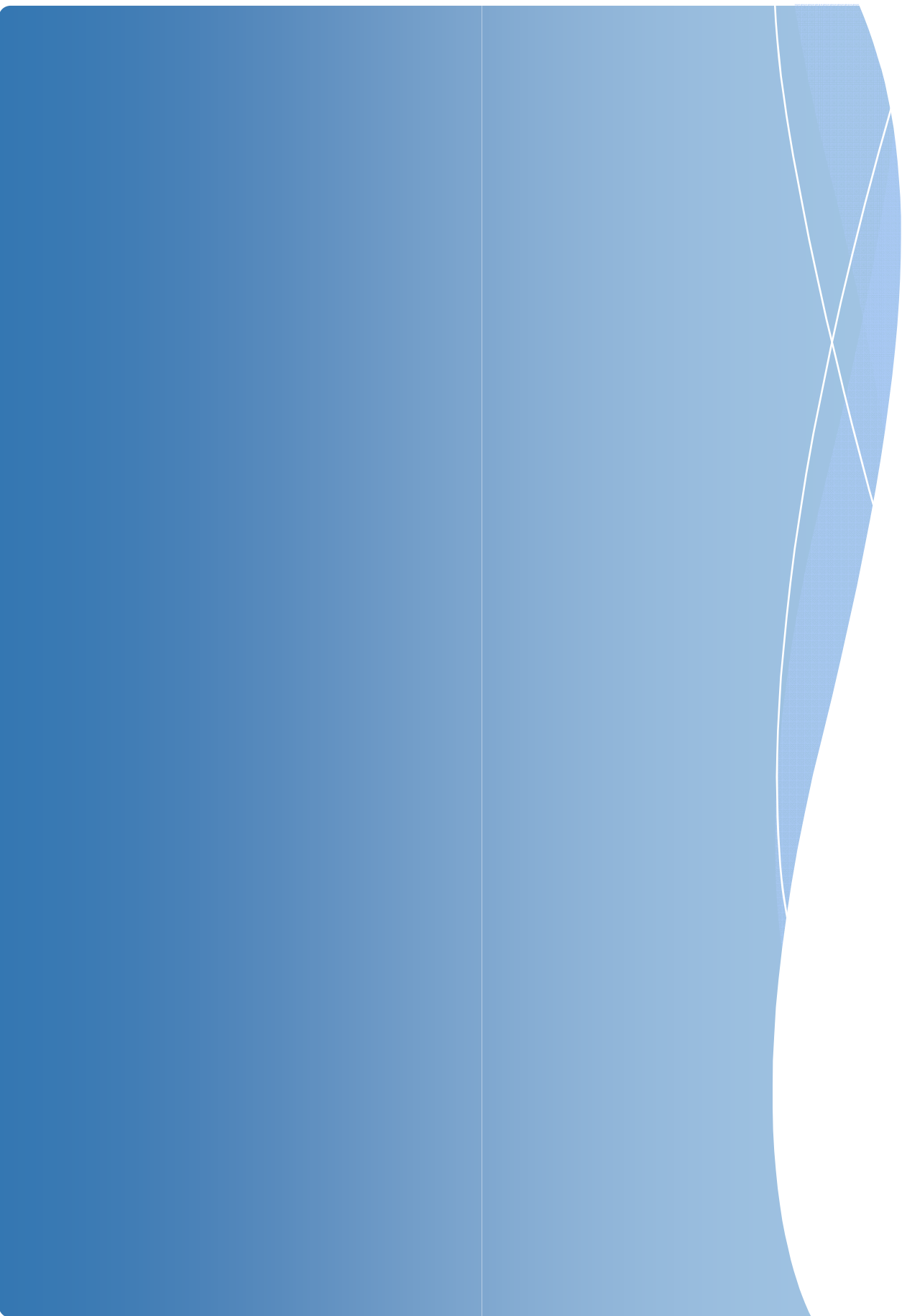
- Ten mineralization rock samples were randomly taken around from the study area.
- The first group of **Au** and **Fe** are *strongly associated*.
- And then the second group of **Cu** and **Zn** are moderately correlated and *they are correlated with first group elements*.
- The third group of element **Ag** and **Pb** are associated and which is *moderately correlated the rest element Sb*.
- **AgPbSb** are positively correlated and weakly associated with **AuFeCuZn**.

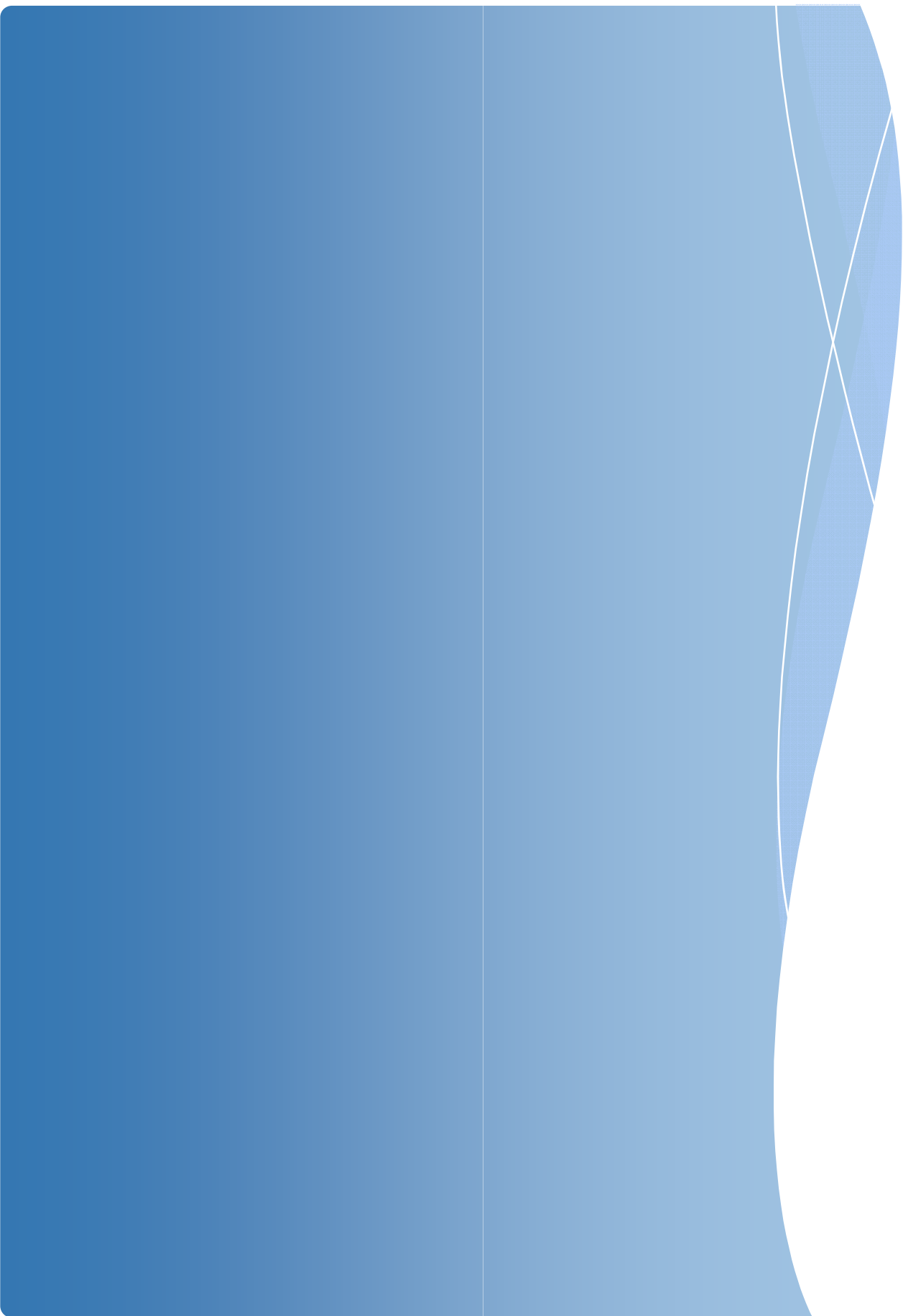


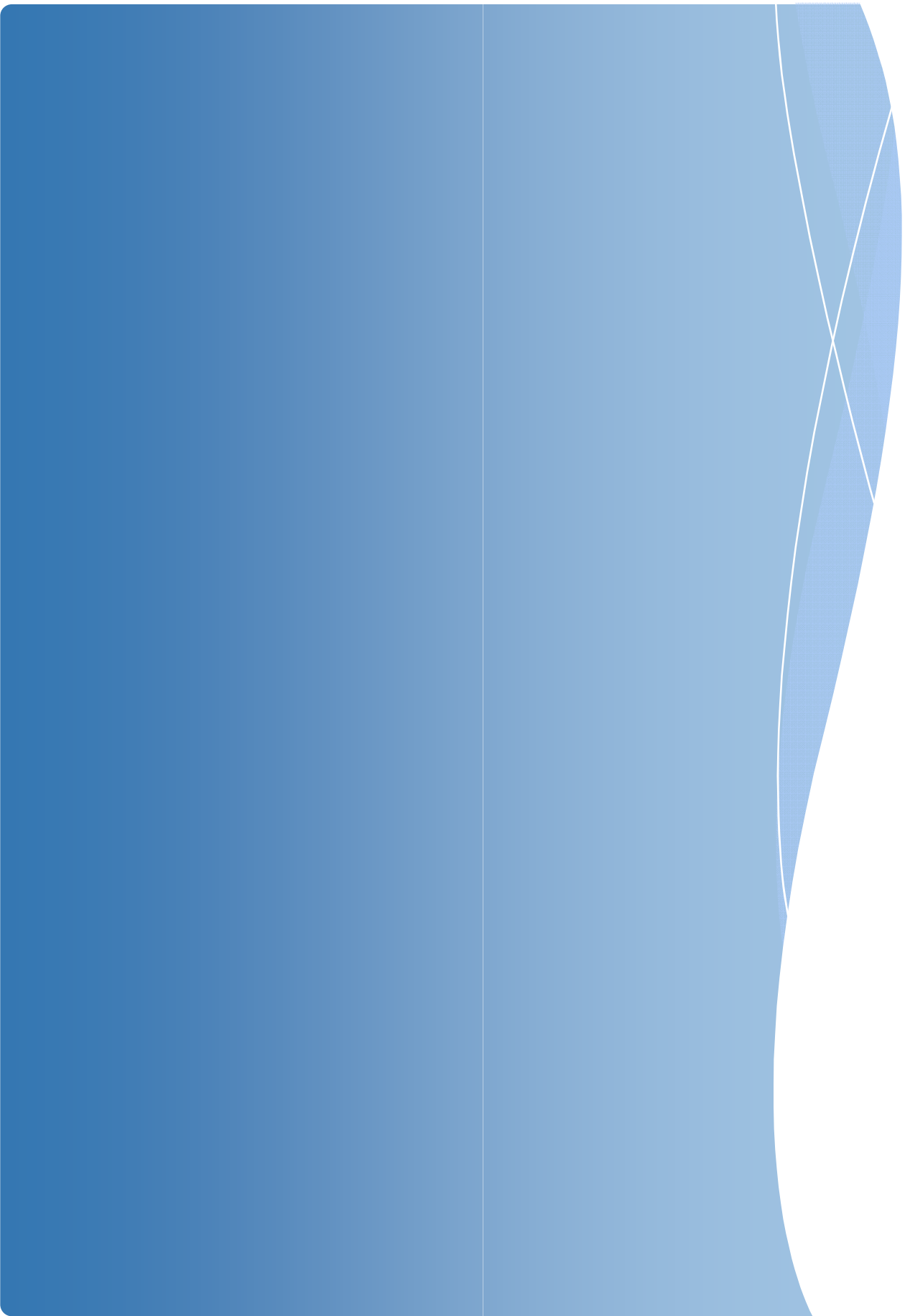
X-ray Fluorescence (XRF) analysis of ore samples

- * Four representative samples of galena bearing samples were selected for XRF analysis
- * The percentage of galena is ranging from *1.498 to 32.696 (%)*
- * Barite is *0.224 to 64.016 (%)*
- * The weight percent of the elements in each sample are shown in table:

Element(%)	Kachinlay (K ₁)	Sinthe (S ₆)	Sinthe (Extension) (S ₃)	Near Sinthe (0.3 m vein) (S ₁)
Si	4.814	0.486	0.164	0.476
P	0.191	0.219	0.165	0.221
S	0.941	8.41	1.025	8.770
Ca	33.305	0.225	39.594	0.195
Fe	2.420	0.475	1.035	0.611
Cu	0.016	0	0.012	0.057
Ba	0.224	60.704	3.903	64.016
Pb	32.696	6.996	29.972	1.498
Mg	1.158	0.016	1.67	0
Al	0.073	0.104	0	0.09
Mn	0.185	0.051	0.07	0.034
Others	23.977	22.314	22.390	24.032







ECONOMIC ASPECTS

- * The study area **lies** just around the **Shweminbon- Lebyin area**
- * This area is **very famous** for **gold and antimony explorations**
- * The economic aspect of the study area is *lead mineralization*
- * **Tonnage** of galena ore reserves – **9172** metric tons (D.G.S.E)
- * **Kachinlay work-site** is still working and exploration
- * Mainly used subsurface mining methods _ **Adits & Shafts**
- * **Concentration** _ breaking up pieces with **crusher & hammer**
- * **Hand picking** is the most effective concentration method
- * Lead exploration is **obscurer than** the gold and antimony exploration
- * This is the **main factor** for the **low investment** of *lead exploration*



**Old Adits
(abandon)**



**Shafts
(still working)**



**Concentration of
collected galena ore**

CONCLUSIONS

- * The occurrences of lead mineralization are mainly confined in the Mergui group of clastic sedimentary rocks and carbonate rocks (Carboniferous_ Lower Permian).
- * All the occurrences of barite-galena prospects lie at the western part of Yebu village.
- * Mineralization was formed various features,
 - * including host-rock replacement and fractures filling which are *due to structural control and brecciation*.
- * Dolomitization and structural control are mainly to serve as *pathways for mineralization*
- * In the study area, the ore mineral is mainly galena.
- * The gangue minerals consist of barite, calcite, dolomite and quartz.
- * Pyrite, chalcopyrite, covellite and chalcocite are associate minerals
- * The trend of galena bearing barite veins and mineralization are found along the fracture and nearly parallel direction to host rock.
- * Silicification is one of the evidence of hydrothermal alteration which comes from igneous intrusion.
- * Diorite intrusion can be found at near Lebyin village at the southern part of the study area.
- * This diorite may be magmatic source of hydrothermal fluid which is the main source & the simulating agent for mineralization.

CONCLUSIONS

- * The occurrences of galena bearing quartz float, galena bearing barite vein and the galena bearing quartz-barite veins are the hydrothermal criteria.
- * According to the observation, it may be **structural related hydrothermal fracture filling deposit**.
- * **According to the cluster analysis and AAS result**, lead mineralization is strongly associated with silver.
- * Although, the **silver is strongly associated with lead** in AAS results but it *cannot be easily identified under polish section*.
- * Therefore, **lead (Pb) is positive correlated with silver (Ag)**
- * XRF results - percentage (%) of galena is **1.498 to 32.696**
- * Barite _ **0.224 to 64.016**
- * Comparison of XRF results_ galena **is more detected in carbonate hosted rock** than galena bearing barite veins.
- * **DGSE** calculated for tonnage of **Pb _ 9172 metric tons**

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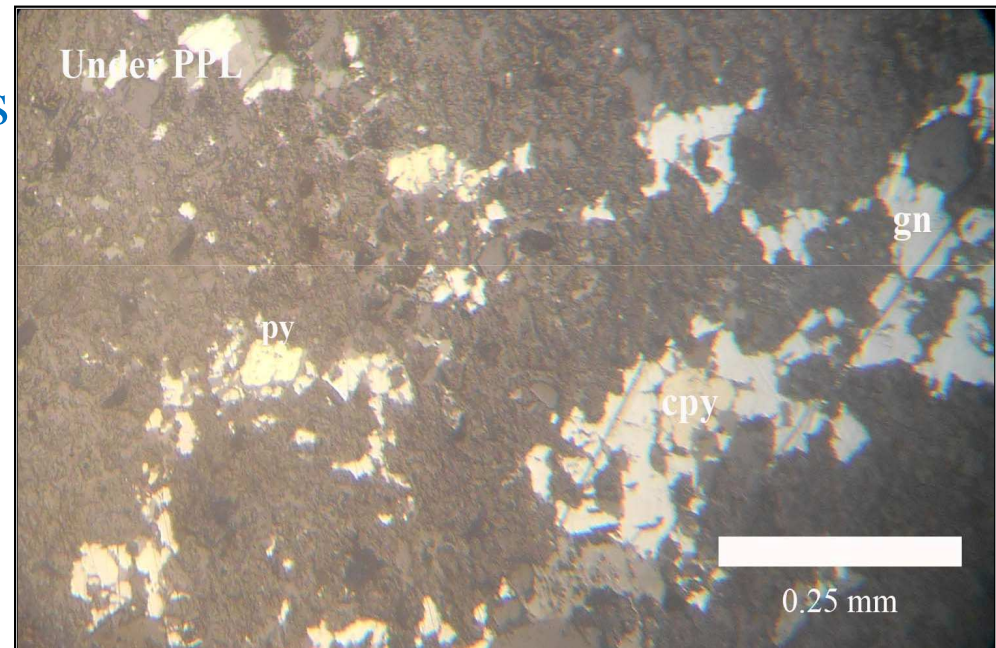
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Thank you for your kind attention!



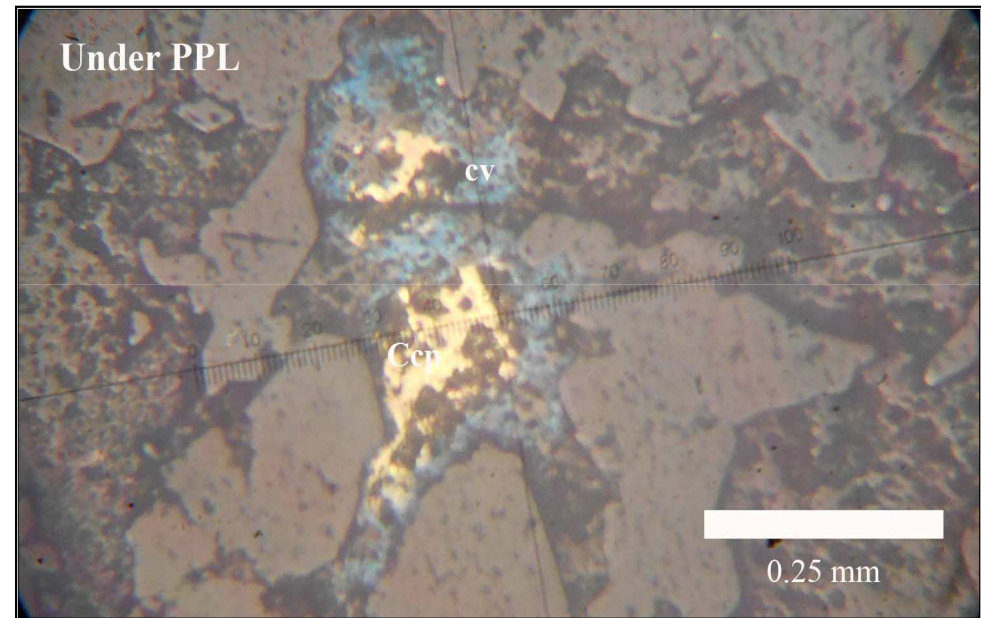
6.3 Ore Mineralogy of the study area (Pyrite)

- * In hand specimen, pyrite is rarely *occurs* as fine grained *diessemination*
- * Under ore microscope, it shows *yellowish white* coloured
- * usually appear *very bright* and subordinate amounts are *intergrown with galena*
- * A few are found *disseminated* in barite
- * Some grains are *cataclased*



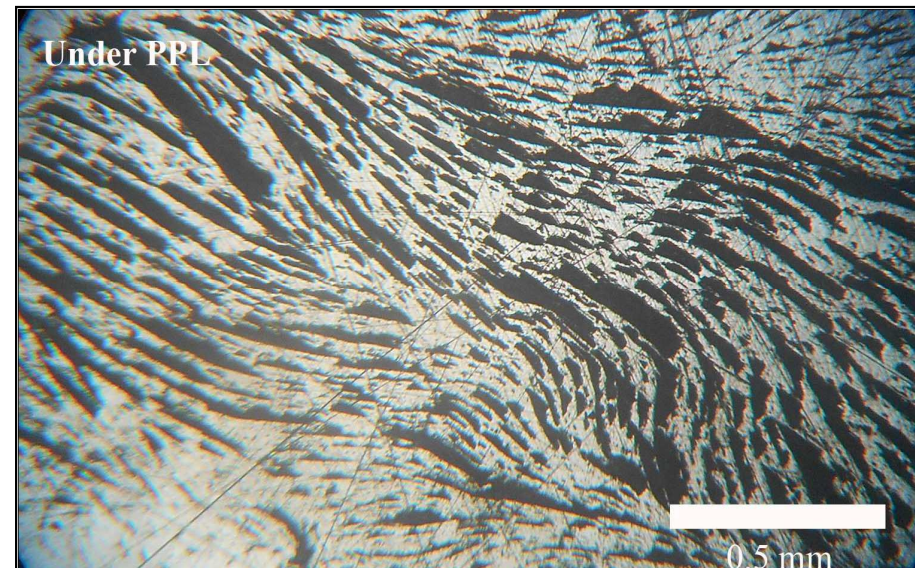
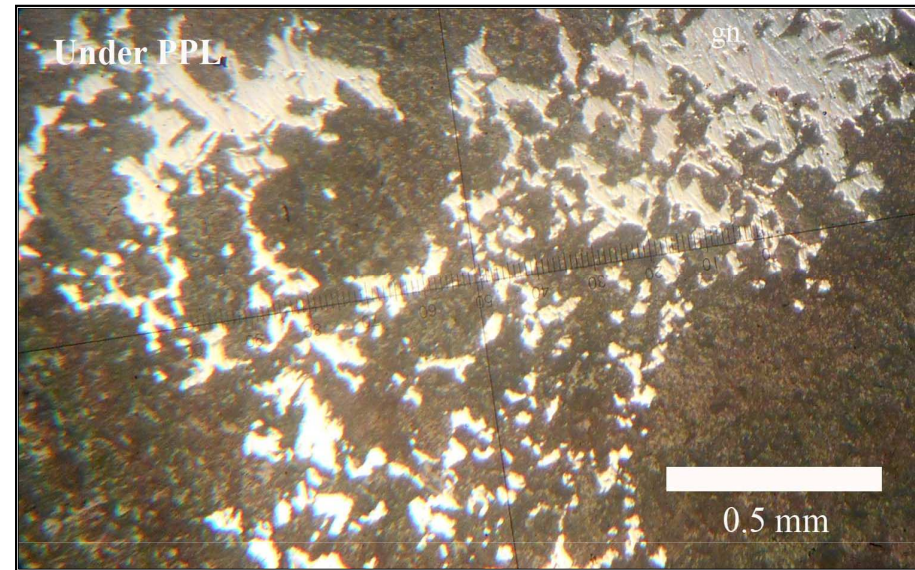
6.3 Ore Mineralogy of the study area (Chalcopyrite)

- * Copper **sulphide** mineral
- * Hard to see in hand specimen
- * Under ore microscope, **yellow coloured**
- * Its **reflectance** is *less than pyrite*
- * **Common in fracture** of sulphide minerals
- * Shows *anhedral crystals*, partially **replaced/rimmed** around **covellite** grains
- * Net texture or may be **infilled texture**
- * Suggested that the **chalcopyrite** *altered to* **covellite**



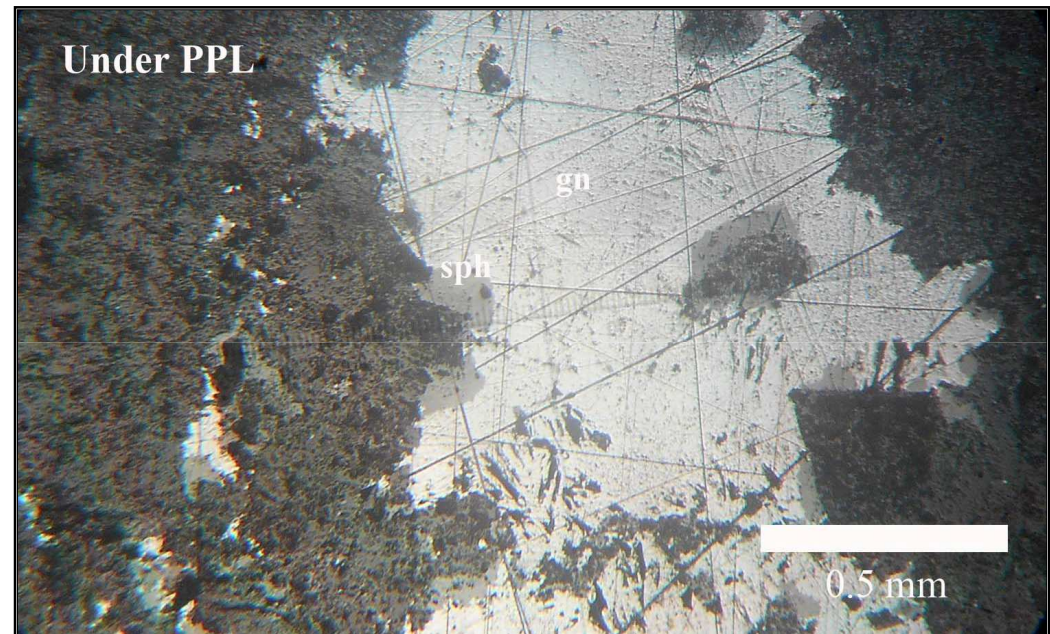
6.3 Ore Mineralogy of the study area (Galena)

- * In hand specimen, galena commonly cubic form and fine grained aggregate crystals
- * Lead grey to silvery coloured that shows *metallic lustre*
- * Under microscope, galena **shows** *bright white colour and numerous triangular pits*
- * Triangular pits are characteristic of galena
- * It is **isotropic** but sometimes very weakly anisotropic
- * Not only **along fracture** but also found **interstices in gangue minerals**
- * Some are also **found** as **infill texture** with gangue
- * **Curved cleavage pits** that have developed in galena as a result of *post-depositional deformation*



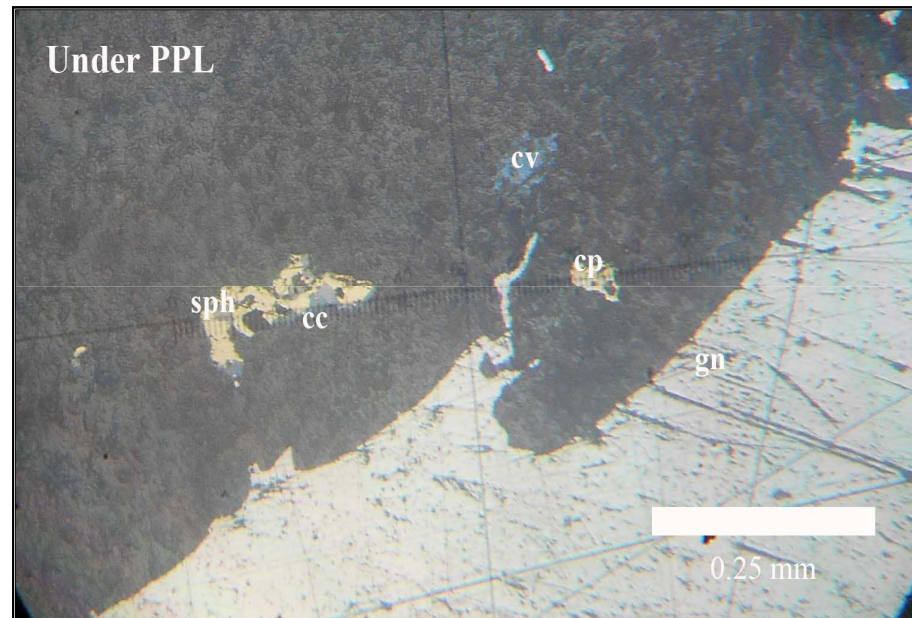
6.3 Ore Mineralogy of the study area (Sphalerite)

- * In hand specimen, **sphalerite** cannot be seen
- * Under ore microscope, it **shows** *light grey coloured* grains **associated** *with galena at outer margin*
- * It is **darker than** most *ore minerals* but **brighter than** the *gangue minerals*
- * Shows *anhedral* grains
- * Sphalerite is typically associated with galena



6.3 Ore Mineralogy of the study area (Chalcocite)

- * **Associated** with *copper and iron sulphide*
- * In hand specimen, it is hard to see
- * Occur as *primary mineral in veins*
- * But also occur as *supergene mineral*
- * **Hypogene** chalcocite is usually *coarse grained*
- * **Supergene** chalcocite is *fine grained*
- * In the study area, can be seen fine grained under ore microscope
- * **Shows** *anhedral, bluish tint* and hosted in gangue



6.3 Ore Mineralogy of the study area (Covellite)

- * Covellite *is not an abundant* mineral
- * Also **secondary product** of copper mineral
- * In polished section, **covellite** gives *strong blue-violet* and *anhedral*
- * Shows **strongly pleochroic** and anisotropy is very strong with **bright firey orange** colours
- * **Chalcopyrite** is *partially replaced* by the **covellite** and infilled texture
- * Covellite **occurs** along the grain *margin of galena*

