Statistical Data Analysis on Menetaung Stibnite, Ywa-ngan Township, Shan State (south)

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Abstract

The study area is situated in the southwestern part of the Pindaya Range, Ywa-ngan township, Shan State (south). The area is bounded by N.Lat.20º 55' 15" to 21º 0' 00"and E.Long.96º 33' 30" to 96º 37' 40" in one-inch topographic map of 93 D/9. In the study area, stibnite is observed in three localities, namely at C.M.E mine, Linle-in mine and outcrop nature at mile 9/3 along Alegyaung to Menetaung car road. The main ore bodies at the mine are stratoid or lenticular in shape with feathering like features into the joints and voids of the host limestones. Stibnite is a silvery-white, accicular form, sometimes shining lead grey, soft and brittle in character. Stibnite is present in the form of polysynthetic, prismatic and accicular crystal. Stibnite bearing veins occurred as fissure-filling nature. Stibnite mineralization is low temperature hydrothermal product and is a carbonate hosted type. Stibnite contains 10. 1612 mean, As_2O_3 has 0.1018 mean, and PbO has 0.0294 mean. These two oxides are linked with each other. But Fe_2O_3 has 2.0876 mean, ZnO has 0.1363 mean, TiO_2 has 0.2980 mean and SrO has 0.0197 mean. These four oxides are other links for stibnite formation. Stibnite vs arsenic and stibnite vs lead show positive correlation. But, stibnite vs iron shows negative correlation. The study of dendrogram has two distinct groups: the first group contains stibnite and sulphur is closely linked and later linked by arsenic. That group is closely linked by lead. Another group contains iron and zinc is closely linked. The two distinct groups of stibnite and lead: iron and zinc are later linked in this diagram. They are also linked with strontium and titanium.

Keywords: Menetaung stibnite, accicular form, fissure-filling nature

Introduction

The study area is situated in the southwestern part of the Pindaya Range , Ywa-ngan township, Southern Shan State. The study area is bounded by vertical grids 09 to 17 and horizontal grids 36 to 46. It is demarcated by Latitude 20º 55' 15" to 21º 0' 00" N and Longitude 96º 33' 30" to 96º 37' 40" E in one-inch topographic map of 93 D/9. The study area is approximately 10.5 square kilometer which is located south of Ywa-ngan township. This area can be arrived from Yangon to Aungban by car and then Aungban to study area by car. The location map of the study area is shown in figure (1).

Materials and Methods

In the field, all traverse lines were measured with the aid of GPS (Geographic Positioning System) reading, Brunton compass, tape and pacing. After that we make polished sections tested by reflected light for ore microscope. Next, we study thin sections tested by transmitted light for petrographic microscope and X-ray powder diffraction method (XRD) was applied for identification of minerals and alteration mineral assemblages. We use EDXRF analysis for chemical composition of ore and host rocks. We study statistical data analysis by using computer aid spss 16 software.

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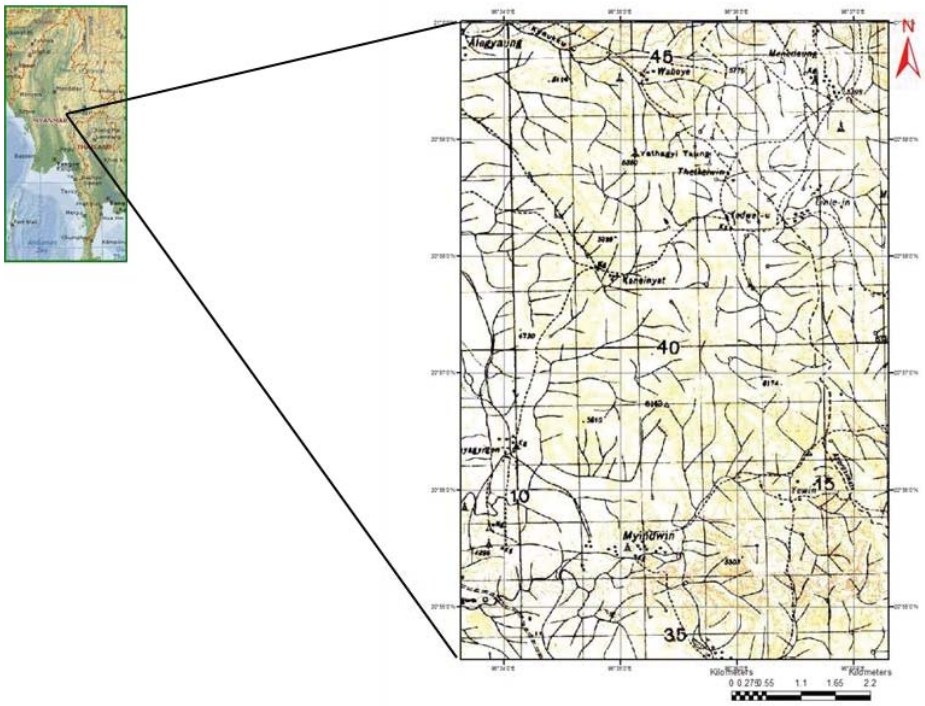


Figure 1 Location map of the study area

Stibnite Mineralization

Antimony is derived from the Latin *antimonium* and stibnite is derived from the Latin *stibium*. The name antimony is derived from the Greek 'never found alone'. The most famous deposit is the Xikuangshan deposit in Hunan Province, China, reputedly worked since the 16th Century to become a world class producer. In addition, more than 140 occurrences of stibnite and other stibnite-bearing minerals are known in Myanmar. The majority of antimony mineralization occurs in the late Paleozoic carbonates (Triassic to Permian in age) and also in the late Paleozoic clastic sediments of the Mergui series. It is generally found in veins or lenses, or both. So far, the best known antimony deposit is at Thabyu, Kayin State, near Thai Border (Ye Myint Swe in DGSE presentation, 2013). Most of the important antimony deposits consist of mineralogically simple deposits and complex deposits. The major antimony deposits were formed from hydrothermal solutions at relatively low temperature and shallow depth. They occur as filled fissures and irregular replacement bodies.

Occurrence of Stibnite Deposits

In the study area, stibnite are observed in three localities, namely at C.M.E mine, Linle-in mine and outcrop nature at mile 9/3 along Alegyaung to Menetaung car road (Figure 2). C.M.E mine site is against by local people, the first field trip and second field trip are totally different in this mine site. Linle-in mine was also closed five years ago because ore grade is not too good. Outcrop nature of fissure-filling type of stibnite vein occurs at mile 9/3 (Figure 3).The stibnite mineralization is associated with the middle Ordovician age carbonate sequences, limestones and dolomites that occur over a 1.5 km sq area at Menetaung. But, local people are against these deposits for mining. Stibnite concentrations in the surrounding rocks enjoy several times concentrations, limestones beds with above crustal abundance. This indicates that the stibnite source rocks are within the nearby strata sequence.

Host Rocks

Stibnite formation is intimately associated with silica and deposition is often in high porosity areas associated with limestone in ore bearing formational or karst type void fill patterns. The ore is primary stibnite with a little pyrite. Silicification is the main indicator for ore forming process. The ore body strike was typically 3m to 6 m long with widths of 0.5 m to 2m at mile 9/3 along Alegyaung to Menetaung car road.

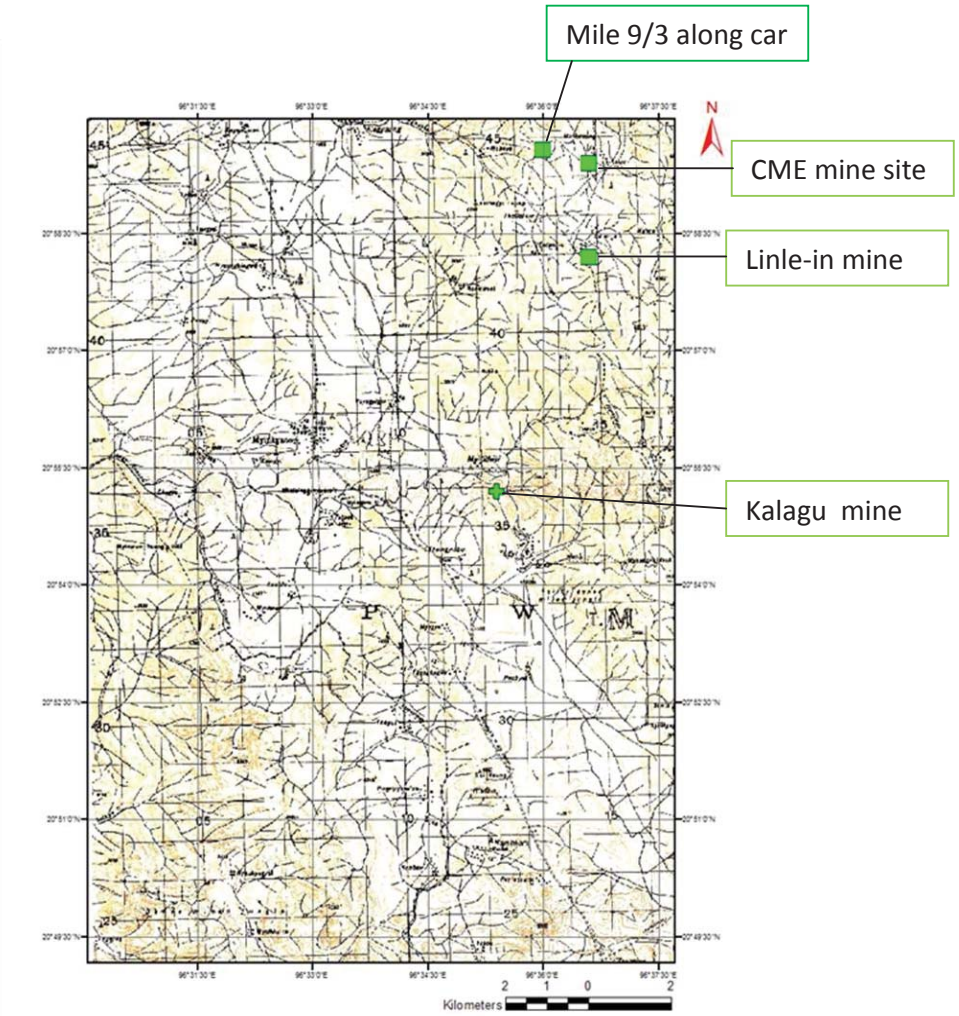
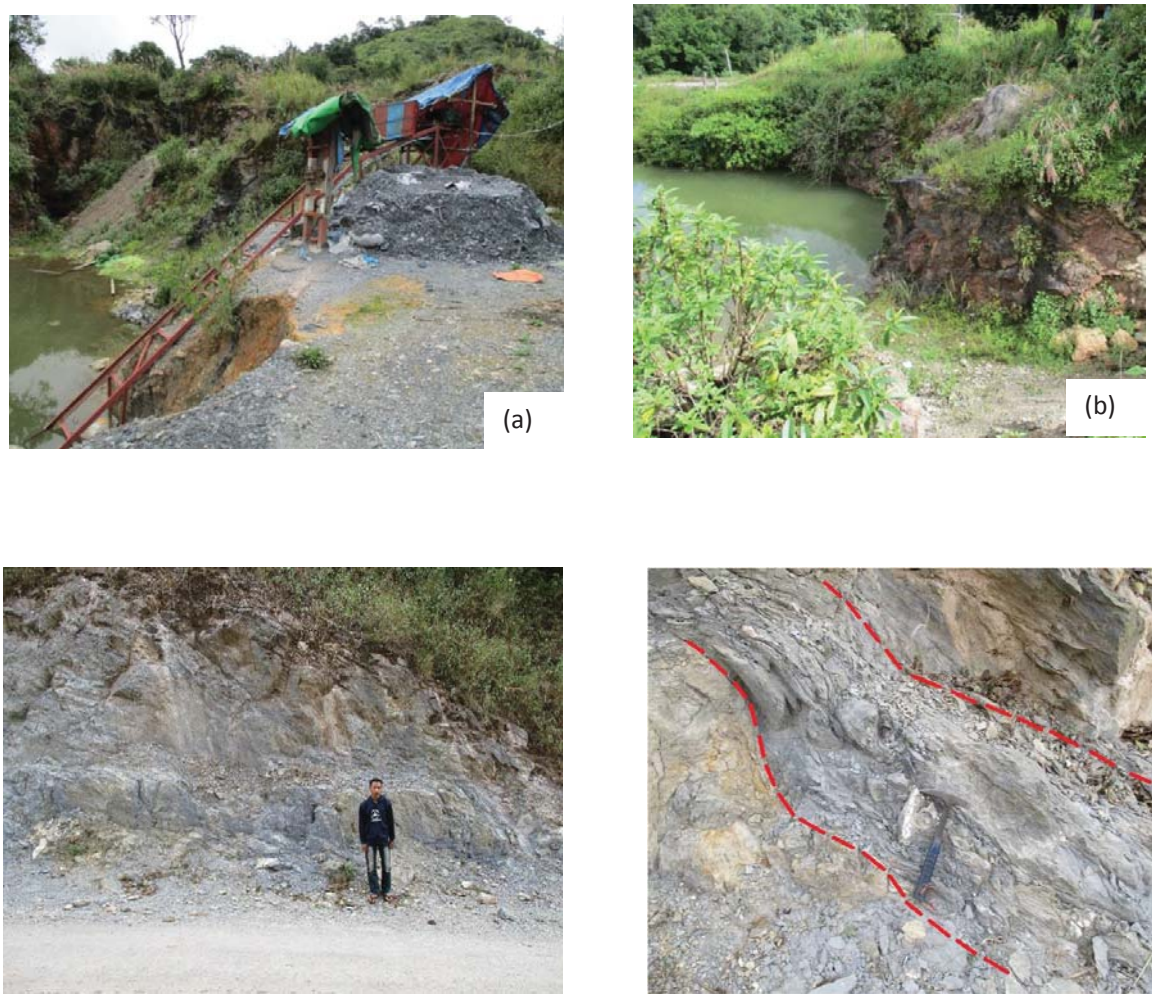


Figure 2 Location of the three stibnite mine site and Kalagu



Figue 3 CME mine (a) Linle-in mine (b) and Outcrop nature of fissure-filling type of stibnite bearing vein at mile 9/3 along Alegyaung to Menetaung car road

Results and Discussion

Stibnite mineralization of the area

The stibnite deposits mainly occur in the central part of the Pindaya Range. C.M.E company and local people are working out for the application of stibnite in two localities and one occurs as outcrop nature. The ore body pinches out in a vertical and lateral sense, where it measures only a few centimeters. The main ore bodies at the mine are stratoid or lenticular in shape with feathering like features into the joints and voids of the host limestone. The stibnite mineralization in the area consists of a number of ore lenses of various sizes which belong to structurally controlled deposits, but are nevertheless isolated bodies with no

connection between each other. Antimony oxides are formed in the oxidation zone of ore deposits and showings as weathering products of stibnite.

Ore Mineralogy

In the study area, the chief ore mineral is stibnite and lead, pyrite, iron oxide and zinc. They are associated with sulphide mineral later form in oxide mineralization. These ore minerals have been recognized only in polish section. Stibnite trioxide (Sb_2O_3) the most common form, is produced by oxidation of the metal or sulphide. Oxygen is evolved during the decomposition reactions. The element also occurs as an oxide, valentinite (Sb_2O_3) and as antimonides and sulphoantimonides of metals like lead, copper and zinc.

Stibnite

Stibnite is a silvery-white, accicular form and shining, soft and brittle metal (Figure 4). They show that the ore is primary stibnite with a little pyrite. The major mineral is stibnite oxides (valentinite, kermesite) examined under XRD result. In polish section, three types of forms are observed namely prismatic, polysynthetic and acicular (Figure 5). Under the microscope, stibnite is white colour and birefringence is weak. It shows yellowish grey, brownish grey, sometimes only slight variations and straight extinction between cross-polar.

Figure 4 Stibnite is Silver-white colour and accicular form of stibnite sample

Alteration of host rocks

Silicification is a dominant type of the alteration in this area because of the stibnite ore bearing solution was intruding along and between the impervious layers of limestone. The boundaries of alteration are not significant in the field. However, it can be indirectly detected by the following physical features:

(1) Abrupt change of the fresh colour
(2) Presence of the brecciation in host rock
(3) Presence of the loose and friable, white or yellowish white siliceous portions in the carbonate host rock.

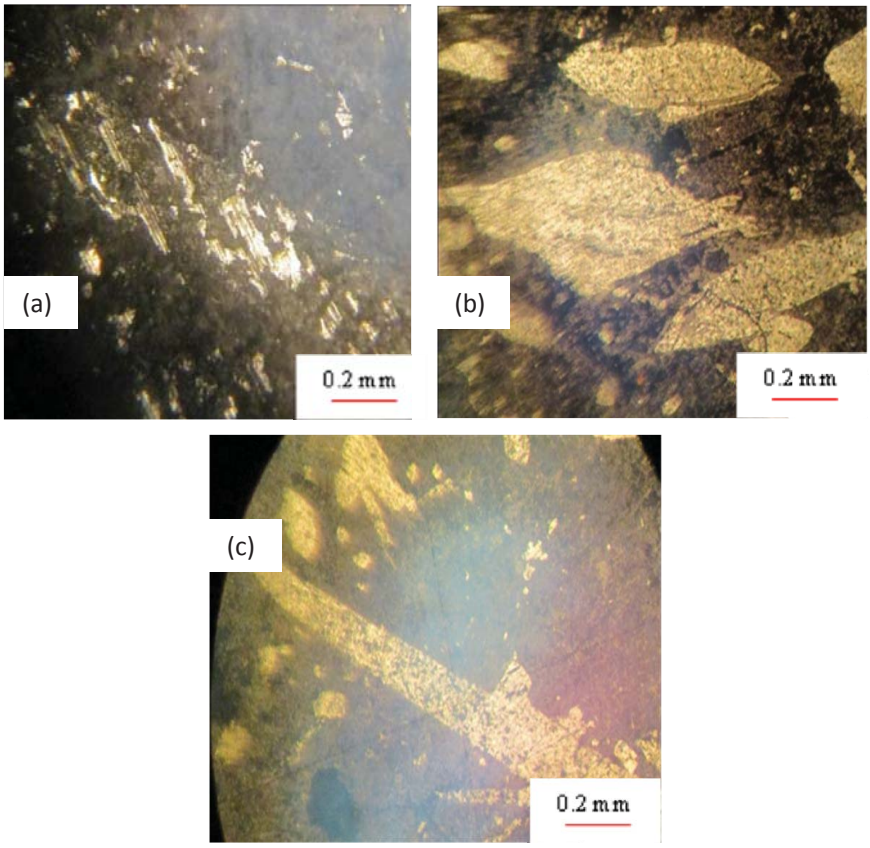


Figure 5 Three types of stibnite under ore microscope (a) polysynthetic (b) prismatic (c) Accicular

Silicification

In hand specimen, the quartz is usually milky white to grey. Various forms of quartz are found in thin section study. Quartz forms a dense mosaic texture and shows irregular extinction. Primary stibnite ore minerals are associated with crystallizing quartz vein.

Pyritization

Pyrite is the most abundant sulphide mineral in mineralization zone. It occurs as euhedral to irregular grains in quartz veins and fractures. Very finely disseminated pyrite crystals are intergrown with very small quartz veinlet. There might be chemical reaction between sulphur and some element such as Fe, Zn, Pb, As etc.

Oxidation of ore deposit

Oxidation is an obvious surface indication of mineralization on the mine area. Alteration assemblages can be roughly divided into oxidized and sulphite zone. It is also found that oxidized zone overlies the stibnite bearing sulphide zone. The reddish iron oxide in this zone is the chief product of oxidation from sulphite mineral of ore body from pyrite.

Geochemistry of stibnite

The geochemistry of the descriptive statistics show that the major oxide has different mean, standard deviation and skewness. Stibnite contains 10. 1612 mean, As_2O_3 has 0.1018 mean, and PbO has 0.0294 mean. These two oxides are linked with each other. But Fe_2O_3 has 2.0876 mean, ZnO has 0.1363 mean, TiO_2 has 0.2980 mean and SrO has 0.0197 mean. These four oxides are other links for stibnite formation (Table 1).

Table 1 Geochemistry of descriptive statistics

Descriptive Statistics

	N	Range	Minimum	Maximum	Mean	Std. Deviation	Skewness	
	Statistic	Statistic	Statistic	Statistic	Statistic	Statistic	Statistic	Std. Error
Sb_2O_3	5	25.58	.42	26.00	10.1612	10.32921	.910	.913
As_2O_3	5	.22	.00	.22	.1018	.09184	.232	.913
PbO	5	.06	.00	.06	.0294	.02897	-.066	.913
Fe_2O_3	5	2.87	.77	3.64	2.0876	1.15547	.453	.913
ZnO	5	.47	.01	.48	.1363	.19690	2.067	.913
TiO_2	5	.52	.00	.52	.2980	.19188	-.880	.913
SrO	5	.01	.02	.03	.0197	.00534	1.858	.913
SO_3	5	16.35	.45	16.80	5.0156	6.93537	1.765	.913
Valid N (listwise)	5							

Histograms and Density distribution

A histogram has the obvious advantages of providing visual information on the total range of values in a data set. Histograms provide a means of comparing similar types of data from different sources and based on different numbers of items. Normal distribution function is commonly a close approximation to raw geochemical data. Most of the elements show normal distribution and stibnite and zinc are positive skewness (Figure 6 a -h).

(a) Distribution of Stibnite

The stibnite is examined in three different areas that have three populations. It ranges from (0.42) ppm to (26.00) ppm. The anomalous zones are observed in the northeastern part of study area. The stibnite histogram of study area is positive skewness shown in figure 6 (a).

(b) Distribution of Arsenic

The arsenic shows four populations and its mean is 0.1018 with standard deviation 0.09184. Its maximum value is 0.22 ppm. The frequency curve of arsenic is nearly normal distribution shown in figure 6 (b).

(c) Distribution of Lead

Lead shows three populations and its mean value is 0.0294 with standard deviation 0.02897. Its maximum value is 0.06 ppm. The frequency curve of lead is broad and normal distribution is shown in figure 6 (c).

(d) Distribution of Fe_2O_3

It shows four populations. It ranges from (0.77) ppm to (3.64) ppm. Its means value is 2.0876 with standard deviation 1.5547. The iron oxide histogram of frequency curve is bell-shaped with normal distribution shown in figure 6 (d).

(e) Distribution of ZnO

It shows four populations. Its maximum value is (0.48) ppm. Its means value is 0.1363 with standard deviation 0.19690. The ZnO frequency curve is positive skewed shown in figure 6 (e).

(f) Distribution of TiO_2

It shows four populations. Its maximum value is (0.52) ppm. Its means value is 0.2980 with standard deviation 0.19188. The ZnO frequency curve is normal distribution shown in figure 6 (f).

(g) Distribution of SrO

It shows three populations. Its maximum value is (0.03) ppm and minimum value is (0.02) ppm. It means value is 0.2980 with standard deviation 0.19188. The SrO frequency curve is normal distribution shown in figure 6 (g).

(h) Distribution of SO_3

It shows three populations. Its maximum value is (16.8) ppm and minimum value is (0.45) ppm. Its means value is 5.0156 with standard deviation 6.93537. The SO_3 frequency curve is normal distribution shown in figure 6 (h).

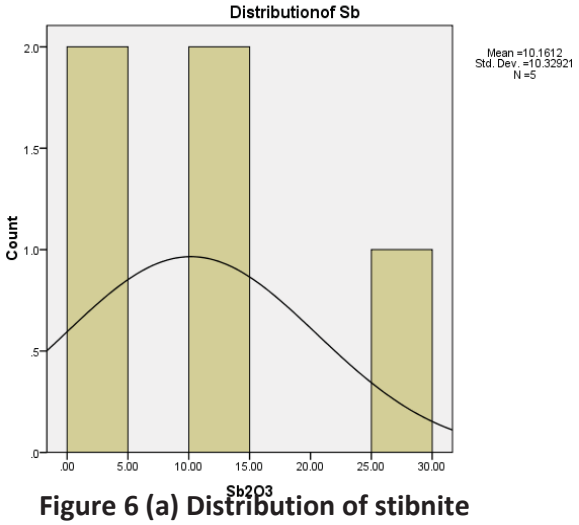


Figure 6 (a) Distribution of stibnite

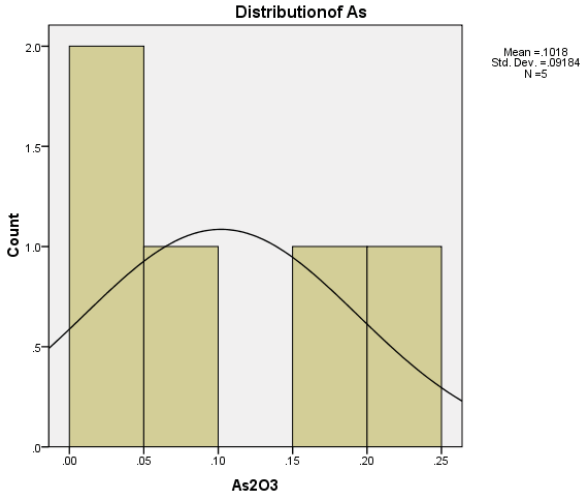


Figure 6 (b) Distribution of arsenic

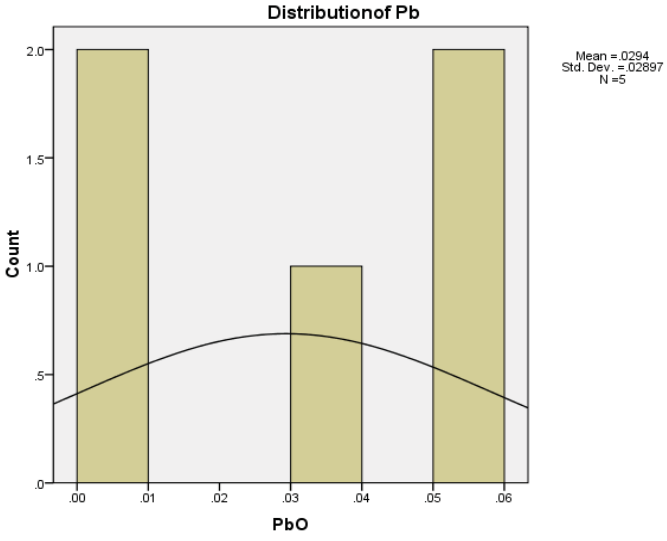


Figure 6 (c) Distribution of galena

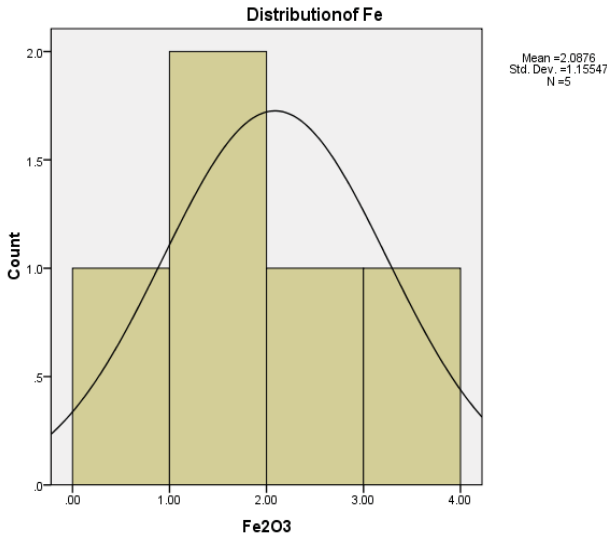


Figure 6 (d) Distribution of iron

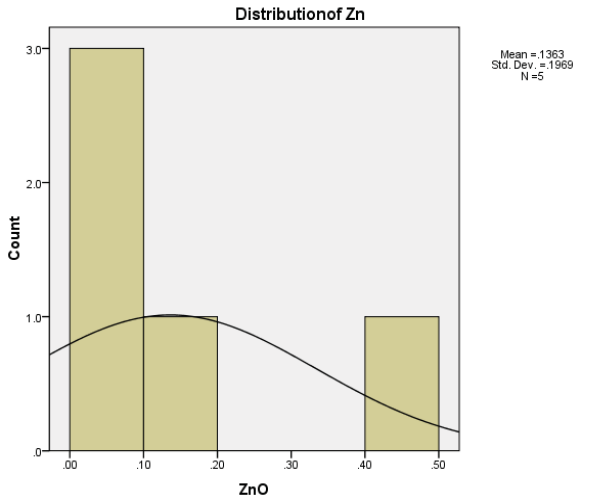


Figure 6 (e) Distribution of

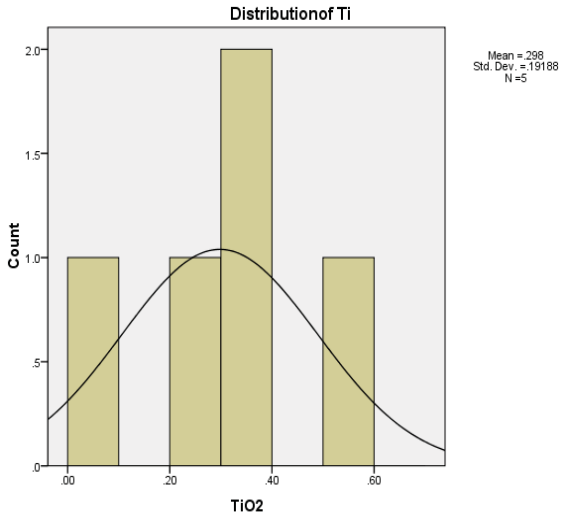


Figure 6 (f) Distribution of

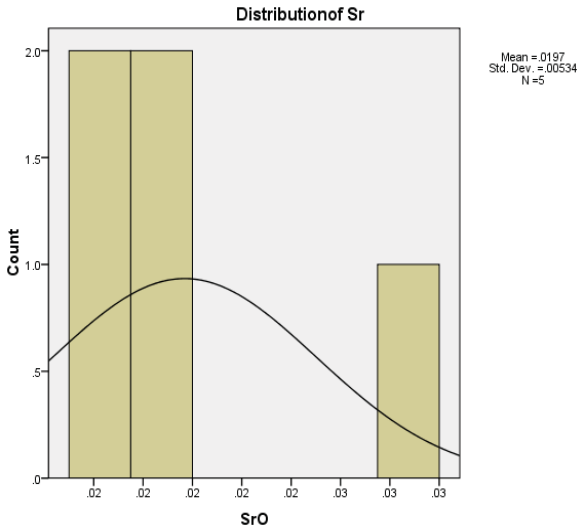


Figure 6 (g) Distribution of strontium

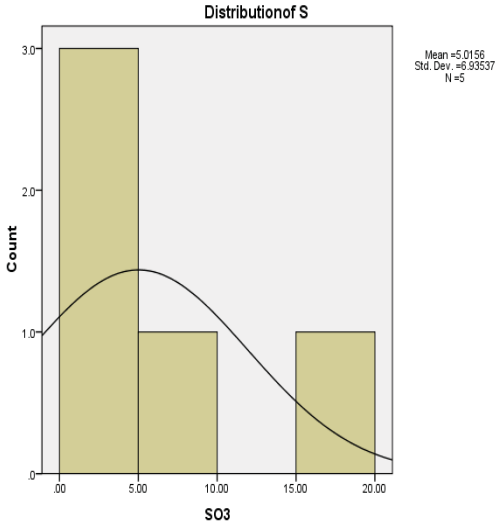


Figure 6 (h) Distribution of

Scatter plot and correlation

This method allows the simultaneous display of both variable and sample interrelationships in the same diagram. It is particularly helpful for the interpretation of geochemical data. Two minerals are compared on the diagram and assigned for correlation.

Stibnite vs arsenic and stibnite vs lead show positive correlation (Figure 7 a & b). But stibnite vs iron shows negative correlation (Figure 7 c). Stibnite vs zinc shows positive correlation and stibnite vs titanium shows negative correlation (Figure 7 d & e). Stibnite vs strontium shows negative correlation but stibnite vs sulphur shows positive correlation (Figure 7 f & g).

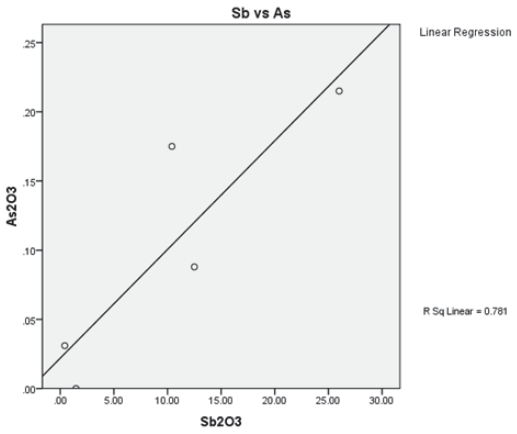


Figure 7 (a) Sb vs As

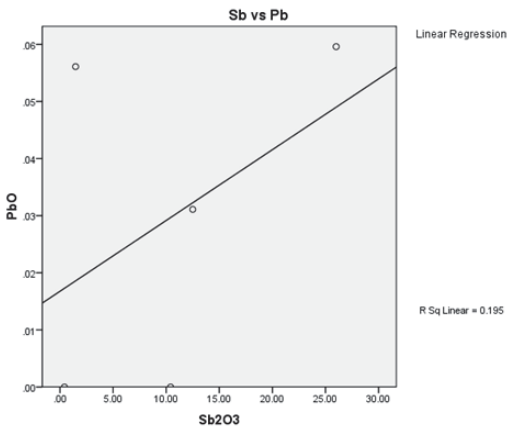


Figure 7 (b) Sb vs Pb

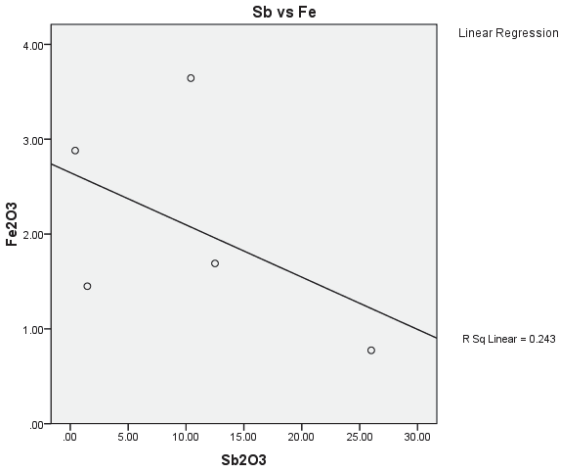


Figure 7 (c) Sb vs Fe

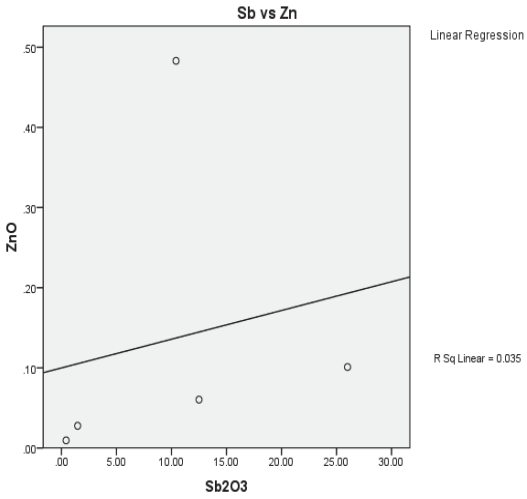


Figure 7 (d) Sb vs Zn

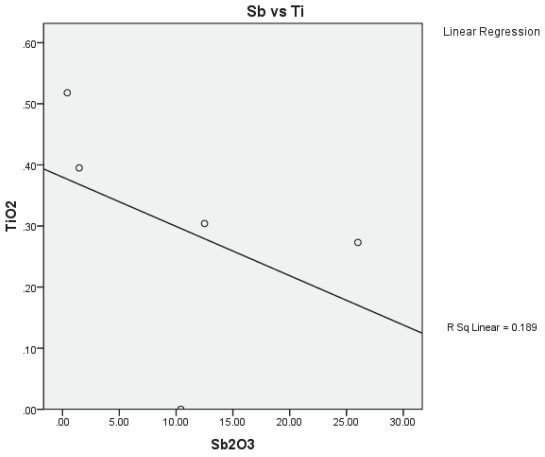


Figure 7 (e) Sb vs Ti

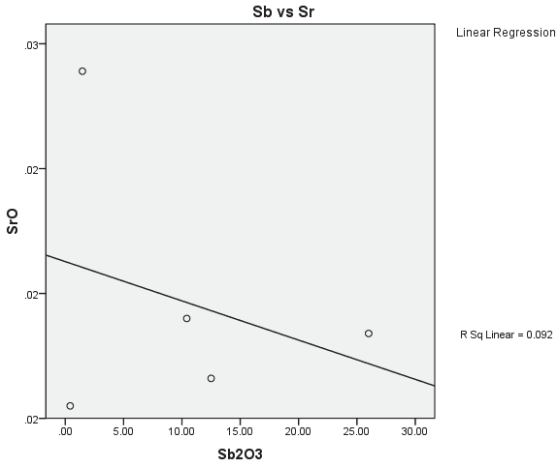


Figure 7 (f) Sb vs Sr

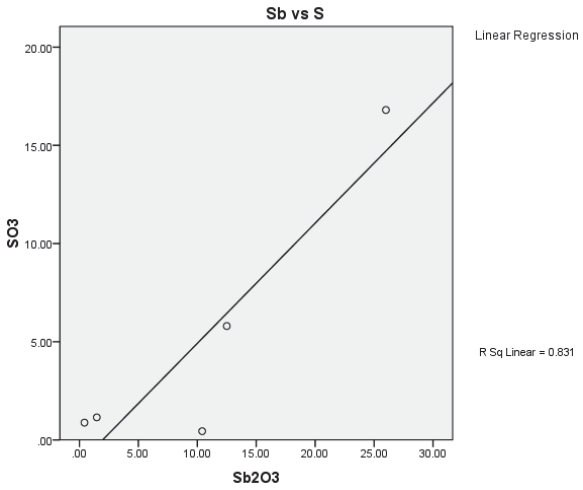


Figure 7 (g) Sb vs S

Dendrogram cluster analysis

The dendrogram has proved a convenient graphical tool for geochemical data analysis. This dendrogram has two distinct groups: the first group contains stibnite and sulphur which are closely linked and later linked by arsenic. That group is closely linked by lead. Another group contains iron and zinc which are closely linked. The two distinct groups of stibnite and lead: iron and zinc are later linked in this diagram. There is another link: strontium is linked by titanium (Figure 8).

Dendrogram using Single Linkage

Rescaled Distance Cluster Combine

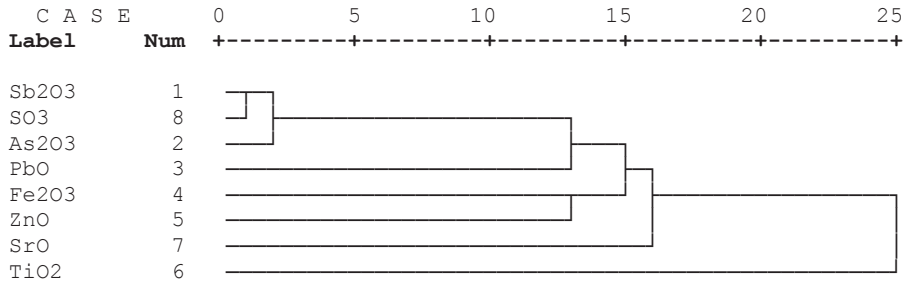


Figure 8 Dendrogram using Single Linkage

Conclusion

The study area is situated in the southwestern part of the Pindaya Range, Ywa-ngan township, southern Shan State. It is demarcated by Latitude 20º 55' 15" to 21º 0' 00" N and Longitude 96º 33' 30" to 96º 37' 40" E in one-inch topographic map of 93 D/9. In the study area, stibnite is observed in three localities, namely at C.M.E mine, Linle-in mine and outcrop nature at mile 9/3 along Alegyaung to Menetaung car road. Stibnite formation is intimately associated with silica and deposition is often in high porosity areas associated with

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Acknowledgements

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