

## Rock geochemical exploration at Thabyebintaung Pb-Zn prospect, Bawsaing, Southern Shan State, Burma

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**Abstract:** The Thabyebintaung prospect is one of the known Pb-Zn occurrences in Lower Palaeozoic carbonate rocks in Southern Shan State, Burma. The Thabyebintaung Pb-Zn prospect is comparable to the principal Mississippi Valley-type deposits of Heyl *et al.*, (1974) in many respects such as host rock stratigraphy, structural setting, mineralogy and ore metal zonation. Rock geochemical study of the Thabyebintaung area was carried out to determine the relationship between the distribution of ore metals (Pb, Zn, Cu, Ag & Ni) in the carbonate host rocks and the known mineralization. 219 rock samples were collected from the surface and underground workings in the Thabyebintaung area. Two mineralized zones (eastern and western) are present in the exploration Adit (50) of the Thabyebintaung prospect. Concentration of Pb in the carbonate host rocks along Adit (50) increases towards both mineralized zones while Zn, Cu, and Ni show high concentrations at the eastern mineralized zone but with no apparent variation of Ag. The areal distribution of Pb and Zn indicated a direct relation to the mineralized zones buried 20-80 metres below the surface—high values of Pb and Zn of the surface carbonate rock samples are coincident with the projected locations of the mineralized zones of Adit (50). Copper contents of the surface rock samples also show high concentrations above the western mineralized zone of Adit (50). Present studies suggest that ore element variations in the carbonate rocks of the study area give a significant relationship with the known mineralization and it is believed that rock geochemical exploration methods can be applied successfully to delineate new Pb-Zn deposits in Bawsaing area, Southern Shan State, Burma.

### INTRODUCTION

The Thabyebintaung Pb-Zn prospect is located about 3.2 km east of Bawsaing (Fig. 1). The Bawsaing-Thabyebintaung area has long been known for its lead, zinc, and silver deposits and currently this area has been the subject of extensive mineral exploration. The Thabyebintaung exploration Adits (50, 51 and 52) (Fig. 2) were driven as one of the extension projects of the Theingon Mine which has the largest Pb-Zn deposit in the Bawsaing area.

Ancient mining activities in the Bawsaing area date back to the 14th Century and numerous lead slags left by early Chinese workers occur in the Theingon Mine area. Since the Theingon and other small deposits in the Bawsaing area have been mined out for many years, the soil and stream sediments around the mine area are highly contaminated. Goossens and Lwin Kyaw (1975) and others in the Dept. of Applied Geology, Arts and Science University, demonstrated that soil and stream sediment geochemical surveys appear to be discouraging in the search for new Pb-Zn mineralization in the Theingon Mine area.

In this investigation, an attempt was made to determine the distribution of ore elements in the carbonate host rock around mineralised zones in the Thabyebintaung

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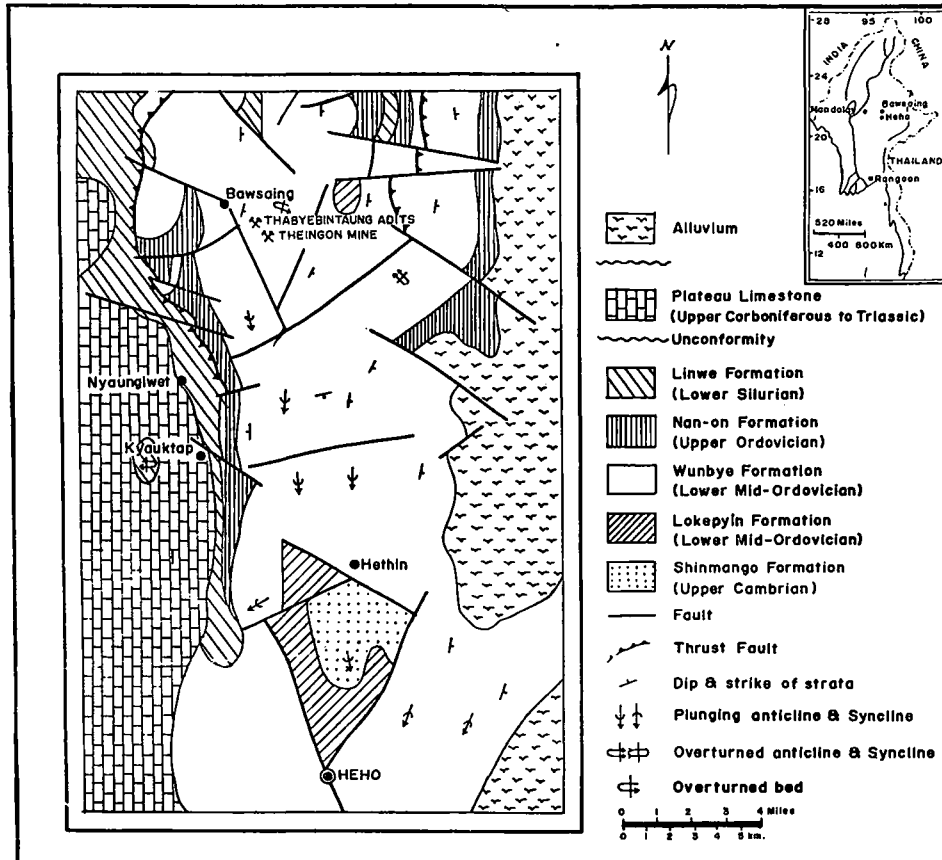


Fig. 1. Regional geologic setting of the Thabyebintaung adits, Bawsaing, Southern Shan State, Burma (From Myint Lwin Thein, 1979)

area in the hope that the elemental distribution patterns may shed light on possible application of rock geochemical exploration methods in the search for Pb-Zn deposits in the Bawsaing area.

The geological background will herein be given for clarification of the present paper. The following summary of geological relationships are based on more complete studies carried out by Myint Lwin Thein (1979) and Zaw Min (1977).

### GEOLOGICAL RELATIONSHIPS

The regional geology of the Thabyebintaung area is shown in Fig. 1. The Bawsaing-Thabyebintaung area is situated on the eastern limb of the Bawsaing-Heho anticline which comprises the limestones, dolomites and siltstones of the Wunbye and Lokepyin Formations (Lower-Middle Ordovician) of the Pindaya Group. These

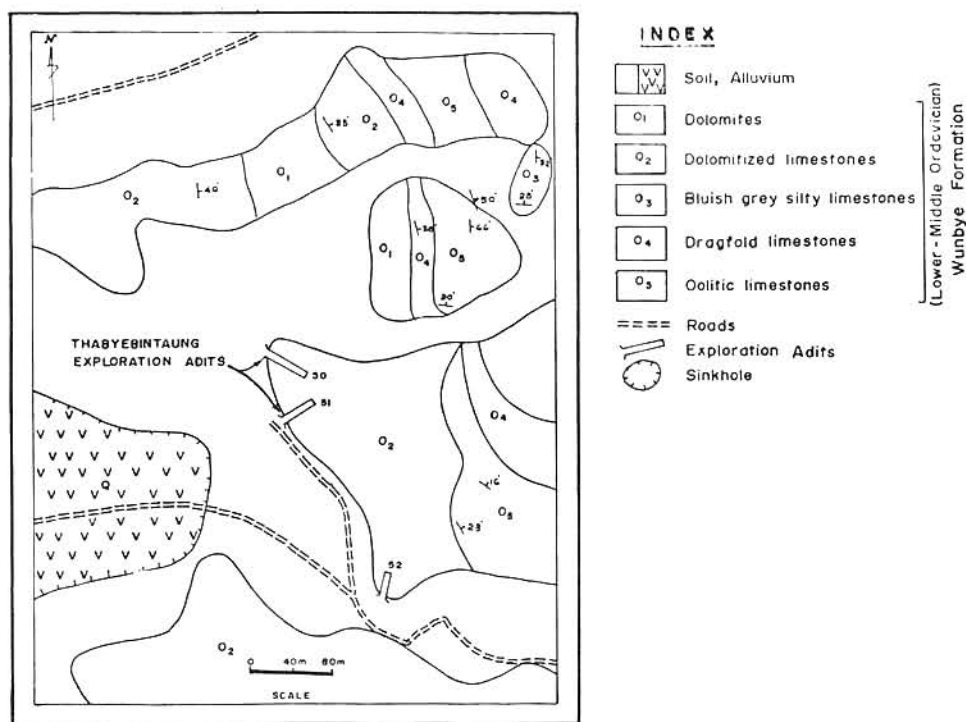


Fig. 2. Outcrop geological map of the Thabyebintaung exploration adits area. Bawsaing, Southern Shan State, Burma (after Zaw Min, 1977)

Ordovician rocks lie conformably on the micaceous sandstones of the Molohein Group (Upper Cambrian) at the Hethin Taung area. To the east and west of the Bawsaing-Heho anticline, the Ordovician rocks are conformably overlain by the Nanon Formation (Upper Ordovician) and the Linwe Formation (Lower Silurian) which again is overlain unconformably by the massive carbonate sequence of the Plateau Limestones (Upper Carboniferous to Triassic). Generally, the Bawsaing area is an anticline plunging south. The northwestern part of the area (comprising the Thabyebintaung area), however, consists of a series of minor to medium scale overturned folds, with their axial planes inclining eastwards and development of local thrusting is common.

The outcrop geological map of the Thabyebintaung area is shown in Fig. 2. The Thabyebintaung area is made up of oolitic limestones, dragfold limestones, bluish grey silty limestones, dolomitized limestones, and dolomites of Wunbye Formation (Lower-Middle Ordovician). The oolitic limestones are thick-bedded, bluish grey, finely crystalline, with iron-stained oolites of up to 0.5 cm across. Dragfolded limestones are hard, compact fine-grained, and interbedded with silty bands which characteristically exhibit dragfolds. The bluish grey silty limestones are medium to thick-bedded, micaceous and commonly stylolitic. Dolomitized limestones are medium

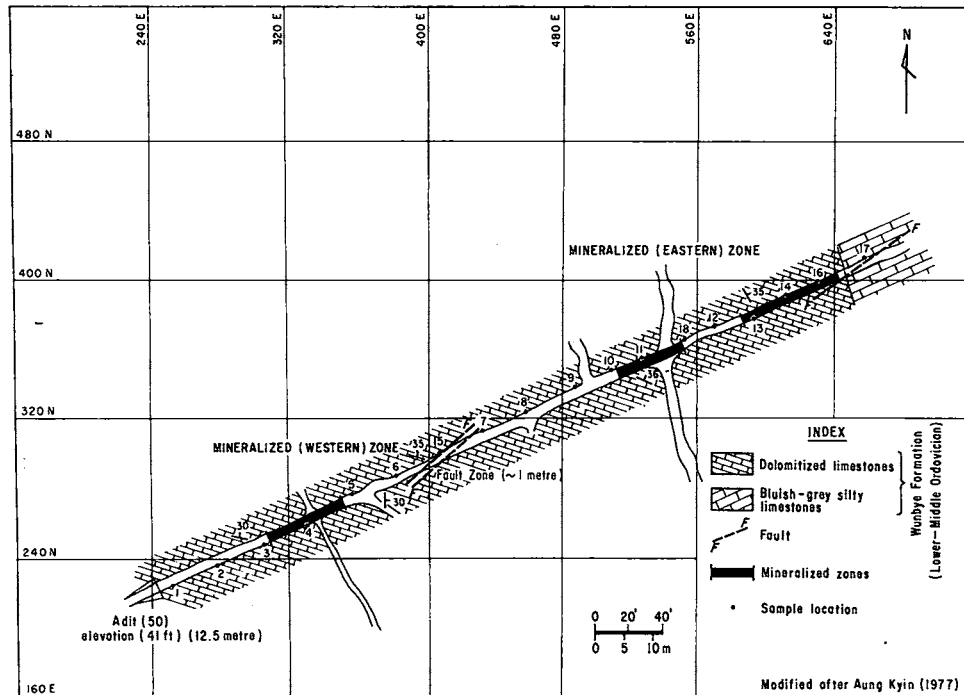


Fig. 3. Generalised underground geological map, Adit (50), Thabyebintaung, Bawsaing, Southern Shan State, Burma.

to finely crystalline, buff to blue, massive, and often oolitic. Dolomites are medium-to coarse-grained, granular, and highly jointed. Bluish grey silty limestones, and dolomitized limestones units are exposed underground. An underground geological map of Adit (50) is shown in Fig. 3.

### MINERALIZATION

The origin of the Pb, Zn, and Ba mineralization in the Bawsaing area have been discussed by many workers. Recently, Myint Lwin Thein (1979) and Goossens (1978) reported the restricted presence of Pb-Zn and Ba occurrences in the Wunbye and Nanon Formations of Ordovician age. Although Pb, Zn, and Ba mineralization in the Bawsaing area is not strictly stratiform, it characteristically exhibits a stratabound setting.

In Thabyebintaung area, mineralization is confined mostly to argillaceous, dolomitic, and ferruginous limestones. Galena is the principal ore mineral and occurs as disseminations and veins. The size of the galena veins varies from a few cm to a metre across. The gangue minerals are calcite, dolomite, siderite, and quartz. Minor barite is also intimately associated with galena in some places. Fluorite is conspicuously absent in the area. At Adit (50), there are two mineralized zones. The first one is located 27 metres from portal and the second, where lead is still under production, lies at 102

**TABLE-1**  
**COMPARISON BETWEEN THE THEINGON-THABYEBINTAUNG**  
**AND THE MISSISSIPPI VALLEY-TYPE DEPOSITS**

	Mississippi Valley type deposits	Theingon-Thabyebintaung deposits
Type of host rock	Mostly in carbonate rocks.	Carbonate rock (oolitic and dolomitic).
Age of host rock	Commonly Palaeozoic sequence.	Palaeozoic (Lower Middle Ordovician).
Structural setting of orebody	Occur in crest, lobes or fractured major domes or gentle anticlinal uplift.	Localised in a limb of east-dipping small overturned anticline.
Mineralogy	Simple mineral assemblage principally comprises of galena, sphalerite, barite and fluorite.	Essentially of galena with minor sphalerite, and barite
Zonation of ore element	Trace element zoning on orebody or district-wide scale.	Overlapping ore element zoning in the orebody.

metres from the portal. At Adit (51), the mineralization possibly occur at 75 metres from adit portal.

The Pb-Zn deposits in the Theingon-Thabyebintaung area may be comparable to the Mississippi Valley-type deposits. Khin Zaw *et al.*, (1983 in preparation) recently reported that Theingon Mine, just southeast of the Thabyebintaung exploration adits, is generally similar to the principal Mississippi Valley-type deposits of Heyl *et al.*, (1974) in host rock stratigraphy, structural setting of the orebody, mineralogy and ore metal zonation (see Table 1). Following a crude mineralogical zoning in the Theingon Mine, geochemical study of the ore element (Pb, Zn and Cu) contents in the carbonate host rocks within the orebody exhibited a broad, but distinct vertical overlapping zonation, the copper (> 100 ppm) being commonly concentrated at the lower levels of the orebody while zinc (> 1000 ppm) and lead (> 2000 ppm) are restricted to the upper levels of the orebody. The Thabyebintaung mineralization is thought to be one ore shoot along the strike of the Theingon and Ywahaung mineralization area which trends NNW-SSE and dips almost vertically. Although no metal/mineralogical zonation is noted at the Thabyebintaung, age and type of host rock and mineral assemblages of the Thabyebintaung are comparable to those of the Mississippi Valley-type deposits. The Pb-Zn mineralization at the Thabyebintaung is localised in a clay-filled solution channel along a limb of an east-dipping small overturned anticline.

Fig. 4 shows the cross section of Adit (50) at Thabyebintaung. The western mineralized zone of Adit (50) lies 20–30m below the surface whereas the eastern mineralized zone occurs at a depth of 70–80m. Few galena stringers and

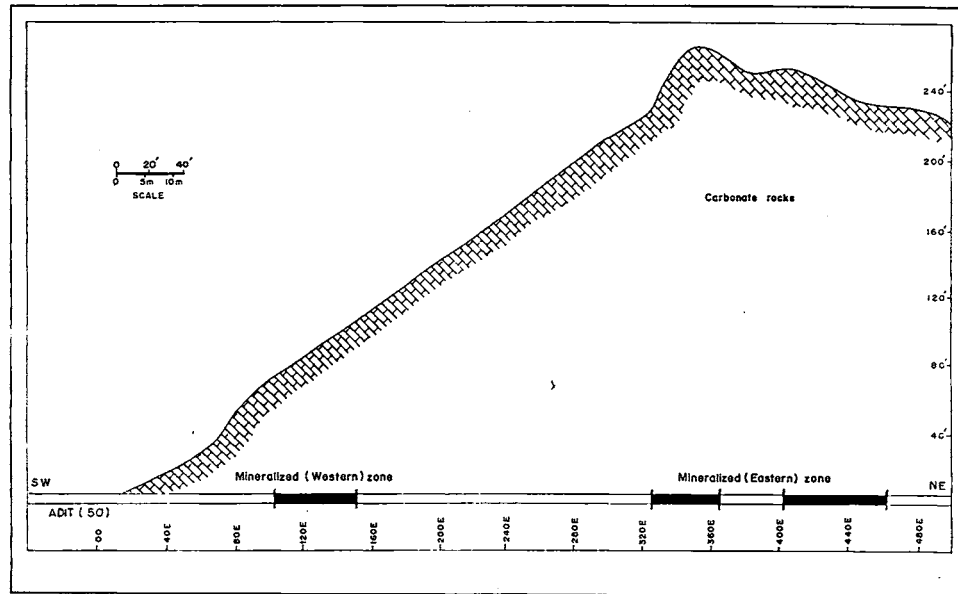


Fig. 4. Cross-section of the mineralized (western and eastern) zones of Adit (50), Thabyebintaung.

disseminations were observed on the surface above the western mineralized zone, but no surface indication was noted above the eastern mineralized zone. The boundaries of the ore zones have been tentatively defined on the basis of the underground stoped out mine workings and exposures of galena vein fillings and disseminations along Adit (50).

## GEOCHEMISTRY

### Sample collection and analysis

214 composite chip samples of rocks were collected on the surface and underground workings in the Thabyebintaung prospect area. Underground sampling was carried out in Adit (50) with the sample interval of four to eight meters (Fig. 3). Surface carbonate rock samples were also collected above Adit (50) on a 10m by 10m grid (Figs. 6 to 8). An effort was made to obtain unweathered samples. The rock samples were crushed and ground to minus 80 mesh. All samples from Adit (50) were analysed for lead, zinc, copper, silver, and nickel by means of Atomic Absorption Spectrophotometer Model *M-1000* after a hot Aqua Regia extraction (Foster, 1971).

## ORE ELEMENT DISTRIBUTION

### Variation in underground samples

The variation of Pb, Zn, Cu, Ag and Ni with promixity to the ore zones in Adit (50) is illustrated in Fig. 5. The ore elements give varying distribution patterns in the host rocks around the mineralized zones. Lead is the principal element and gives a good contrast in the Thabyebintaung area. As the mineralized zone is approached,

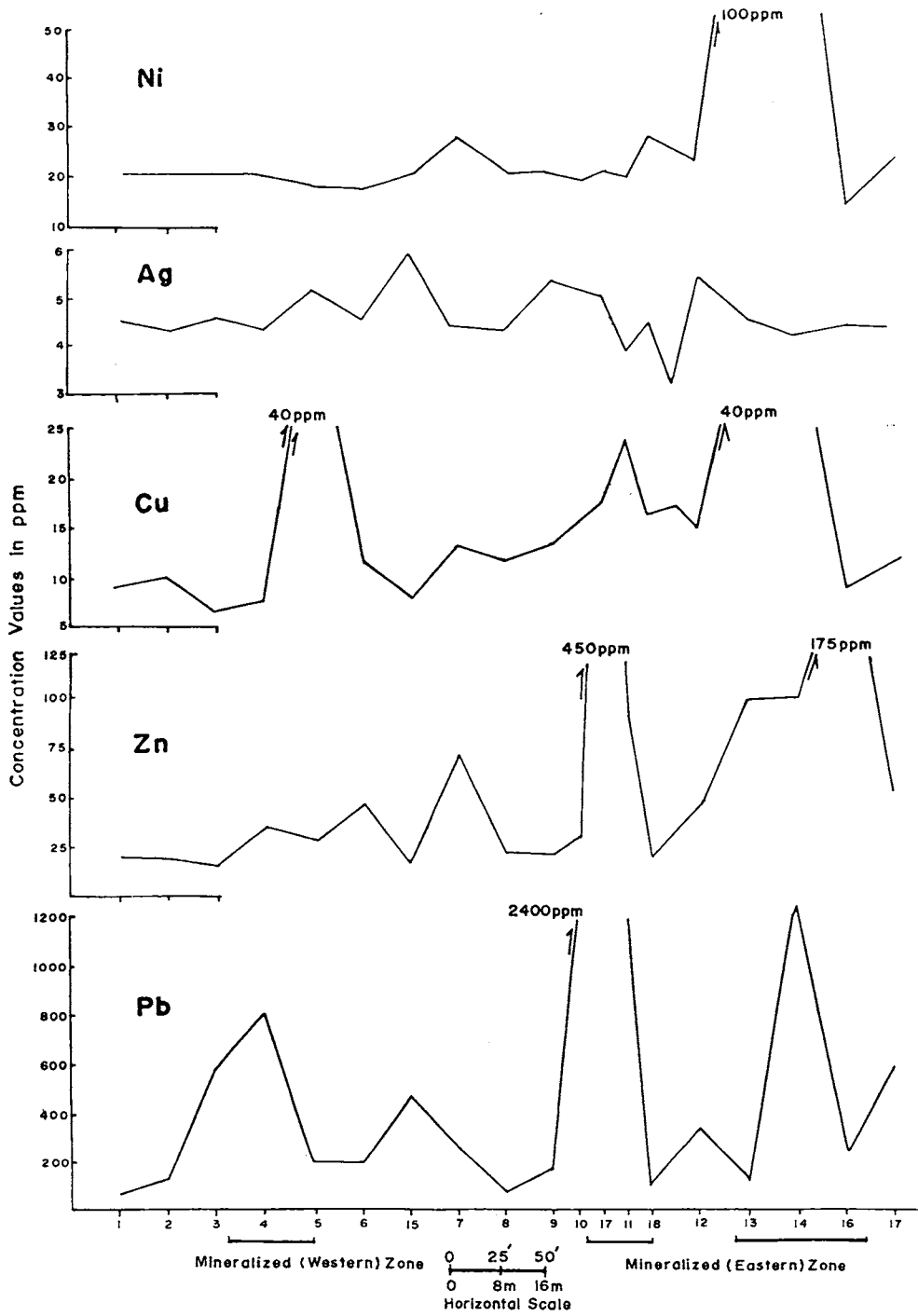


Fig. 5. Ore elements variation along Adit (50), Thabyebintaung area, Bawsaing, Southern Shan State, Burma.

there is a progressive increase in lead content. The concentration of copper generally increases towards the eastern mineralized zone but it does not show high values over the western mineralized area. Instead, high value of copper (40 ppm) is found at the eastern boundary of the western mineralized zone.

Cu and Pb tend to show a reverse relationship in the western mineralized zone. In sample No. 4, for example, Pb is a very high (800 ppm) while Cu is low (< 10 ppm). This relation is reverse in sample No. 5. (Fig. 5) There is also high zinc concentration in the eastern mineralized zone but generally low values in the western mineralized zone. Silver shows no apparent variation with proximity to both western and eastern ore zones. Nickel shows an enrichment in the eastern mineralized zone but very low concentrations in the western mineralized zone.

#### Variation in surface samples

Areal distributions of Pb, Zn and Cu above Adit (50) are shown in Figs. 6, 7 and 8. Two known mineralized zones discovered by aditting were projected to the surface to delineate the relationship between geochemical distribution of Pb, Zn and Cu in the surface carbonate host rocks and buried mineralization (as shown in Fig. 4).

It is indicated that the distribution of ore elements are directly related to the unexposed mineralization in the Thabyebintaung area; two known mineralized zones (eastern and western) projected from the underground working of Adit (50) are coincident with the zones of anomalously high values of Pb and Zn contents (> 200 ppm Pb and > 25 ppm Zn) in surface carbonate host rocks (Figs. 6 and 7). The copper content in surface carbonate rocks also yielded significant concentrations of more than 12 ppm Cu above the western mineralized zone and not above the eastern ore zone of Adit (50) (Fig. 8). It is also noteworthy that the ore element distribution patterns of the surface rock samples have a generally similar trend (NE-SW) approximately parallel to the mineralized zone as well as stratigraphic trend of the area.

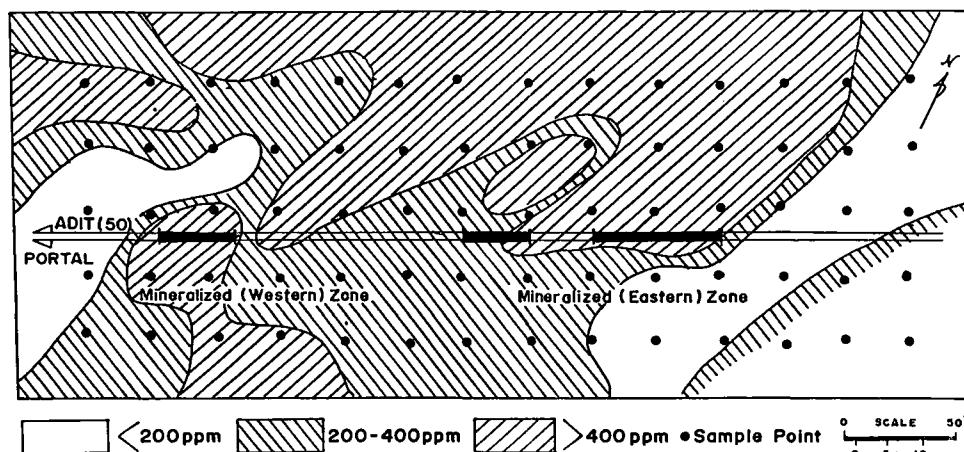


Fig. 6. Distribution of Pb in carbonate rocks above Adit (50), Thabyebintaung.



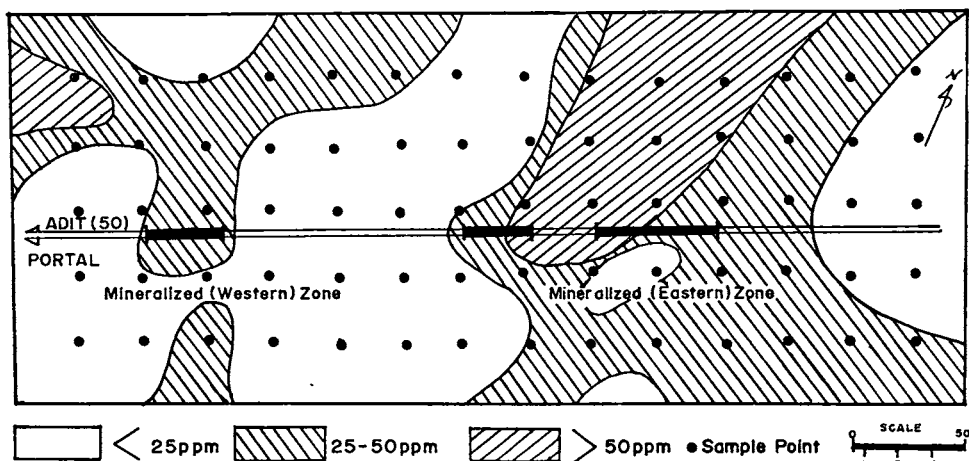


Fig. 7. Distribution of Zn in carbonate rocks above Adit (50), Thabyebintaung.

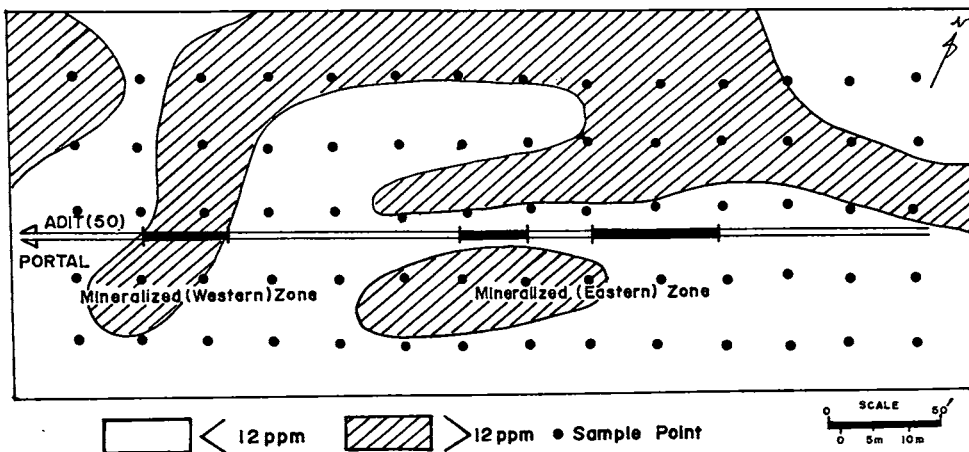


Fig. 8. Distribution of Cu in carbonate rocks above Adit (50), Thabyebintaung.

### DISCUSSION AND CONCLUSIONS

Geological, stratigraphical, and mineralogical characteristics of the Bawsaing-Thabyebintaung Pb-Zn deposits are comparable to those of the Mississippi-Valley type deposits. Present investigation indicates that the Pb contents of the adjacent carbonate host rocks along Adit (50) increases towards the mineralized zones. Zn, Cu and Ni show high concentrations at or near the eastern mineralized zone of Adit (50), whereas, Ag does not increase systematically. Similar trend of metal distribution was also noted in the Theingon Mine (Thet Aung Zan, 1977; Khin Zaw *et al.*, 1983 in preparation).

The zones of anomalously high values of Pb and Zn in the surface rock samples are also found to be indicative of buried mineralization when the two known underground ore zones were projected to the surface. Recent detailed follow-up rock geochemical surveys delineated new anomalous zones at Bomintaung, northeast of the Thabyebintaung area. Later trenching and blasting of these newly found anomalies revealed disseminated galena mineralization in carbonate rocks (Aung Pwa, 1982).

Thus the present study suggests that ore element variations in the carbonate host rocks of the study area show a significant relationship with the known mineralization. It is believed that rock geochemical exploration methods can be applied as one of the prospecting techniques in the search for new Pb-Zn deposits in the Bawsaing area.

Statistical analysis of surface rock geochemical data of some mineralized parts of the Thabyebintaung (Aung Pwa and Khin Zaw, 1979) also suggests that rock geochemical exploration techniques can delineate anomalous Pb-Zn mineralized areas in the Bawsaing area. Further, it has also been demonstrated that regional and detailed rock geochemical exploration can delineate the mineralization trends in Southern Shan State (Aung Pwa, 1979).

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