CHAPTER III

HOST ROCK CHARACTER

The middle to upper Ordovician limestone outcropping along a strike length of 50 kilometers, is of paramount importance at Song Toh as it contains all the known uneconomic and economic Pb-Zn mineralization. The ore-bearing carbonate host rocks exhibit structural and textural features which has been produced by a complex interplay of sedimentary, diagenetic and tectonic processes. As it has already been mentioned in the foregoing chapter that the rocks can be subdivided into three units according to their gray hues, namely light gray, gray and dark gray. Moreover, they have been intersected in all exploratory drilling holes in the Song Toh mine area. On the basis of logging of drilling cores obtained from some fifty bore holes, a detailed lithological succession of the limestone occuring in the mine area have been established as illustrated in figure 25 .

3.1 The Light Gray Limestone

The light gray limestone is usually white or light gray or tinted in shades of gray, light and bluish gray. It is laminated to thinly-bedded, slightly dolomitic, calcisiltite (Grabau, 1913) or Sparite (Folk, 1968). The major of the beds are finely laminated with the bedding plane. Parting facilitated by the relative abundance of very thin-layered, discontinuous, argillaceous material.

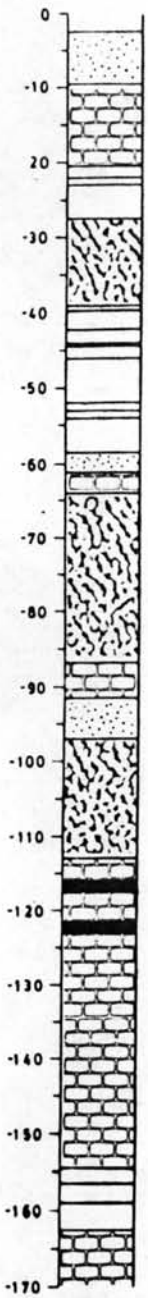
THICKNESS	DESCRIPTION
	Lateritic soil, yellowish brown to dark brown, contains plant debris slag, limestone fragments, floats of Pb-Zn ores 10-20 m in thickness. Gray limestone, dense, contains pink calcite and calcite veinlets, trace of Pb-Zn ores. Light gray limestone, contains disseminated Pb-Zn ores and pyrite. Recrystallized calcite and pink calcite can be found. Gray limestone alternate with dark gray limestone less in calcite veinlets This is a gradational zone between the light gray limestone and dark gray limestone Dark gray limestone graded from the upper part, show highly fracture along clay streak, brittle, irregular folited thin beds abundant calcite veinlets.. Gradational zone between dark gray limestone with gray limestone. Gray limestone intercalated or interbeded with light grey limestone, brittle, contain calcite veinlets, diss-minated pyrite. No trace of Pb-Zn ores. Gray limestone intercalated or interbeded with dark gray limestone. Gray limestone Light gray limestone Dark gray limestone, highly fractures, dark foliated bands, high clay contains, developed microfolds in its textures Light gray limestone with many calcite veinlets, fractures along clay streaks, graded to the lower part Gray limestone graded from the upper part, thin beds, foliated, graded to dark gray limestone Dark gray limestone, dirty, highly fracture, abundant calcite veinlets, shows angle of dip of the strata is 50°, partly contains brecciated fragments about 1 mm. in diameter of dark gray limestone, show sharp contact with the lower part. Light gray limestone, dense, massive, less in clay or shale streak, contains Pb-Zn ore 5-10%. This zone range from 10-40 m. in thickness. The Pb-Zn ores occur as a stratabound type with at least three lenses or branches of the ores in this zone. Types of ore occurrences include filling along bedding plane and fractures, and partly disseminated ores. The other mineral associations are pyrite, barite, calcite, dolomite quartz and minor secondary mineral of galena and sphalerite. The thickness of ore zones is not excepd 10 meters in each lens and branch. The light gray limestone that contains Pb-Zn ores usually shows sharp contact with the upper and lower part but locally interfingering contact may be seen. Gray limestone alternate with dark gray limestone, foliated, graded from highly fractures to more massive toward depth. In part of this zone to the depth, light gray limestone, which no observable Pb-Zn ore, may be alternative beds with the former ones.

Figure 25 Showing a detailed lithological succession of the Song Toh lead-zinc deposit compiled from drilling cores of some fifty exploratory bore holes.

Petrographically, the unit is mudstone grades to wackstone with an increasing of in clastic components (Dumham, 1962). The crystalline calcite is generally fine-grained with varying grain size ranging from 0.03 to 0.70 mm. In places, anhedral to subhedral dolomite rhombs, euhedral quartz and microcrystalline quartz (probably chert) are not uncommon occurring in the calcite matrix. It is noteworthy to indicate that the dolomite appears to replace some of the calcite matrix. Fine-grained pyrite and minor lead-zinc ore are commonly scattered throughout the rock (Figure 26). Moreover, in the relatively coarse-grained crystalline areas, the calcite and dolomite crystals usually exhibit kinking clevages (Figure 27). In addition, where the light gray limestone is associated with relatively strong mineralization both calcite matrix and crystalline masses appear to be intensified replaced by dolomite (Figure 28). It is noteworthy to indicate that the light gray limestone is the most important rock unit because it almost always shows a close spatial relationship with both uneconomic and economic mineralized horizons.

3.2 The Gray Limestone

The gray limestone is usually gray, laminated to thinly-banded calcisiltite. The majority of beds is usually less than 1 cm thick. In general, the rock appears as irregular masses of varying thickness (usually less than 10 m thick) occurring within the intermixed zone between the light gray and dark gray limestone. Moreover, it exhibits mottled structure indicated by the appearance

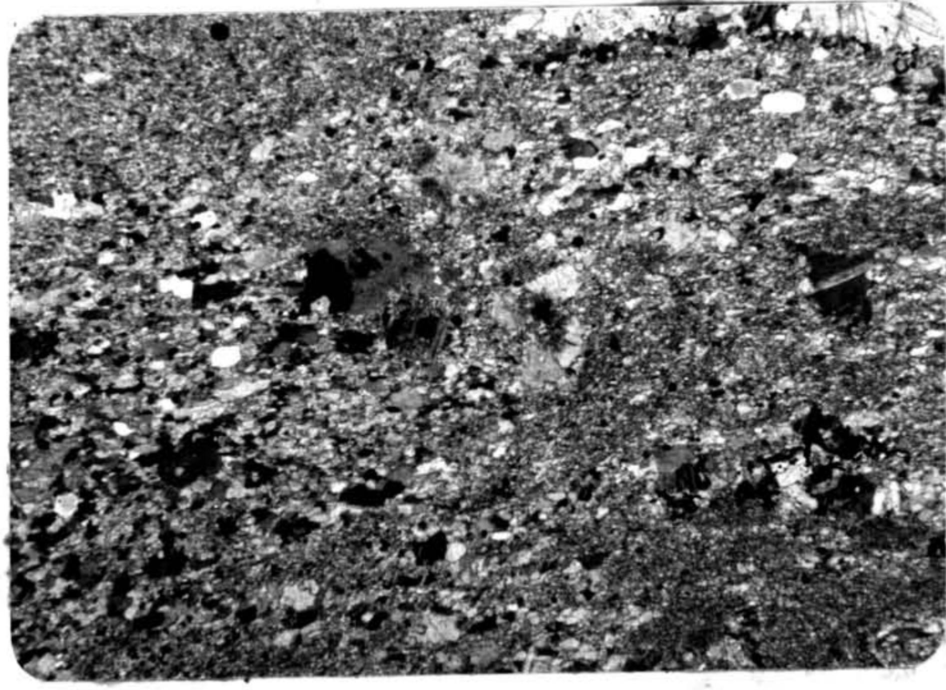


Figure 26 Photomicrograph of light gray limestone showing fine-grained pyrite and minor lead-zinc ore scattered throughout the calcite matrix.
(Thin section, 40 x, crossed nicols)

Figure 27 Photomicrograph of light gray limestone showing coarse-grained crystalline calcite and dolomite which exhibit kinking clevages.
(Thin section, 40 x, crossed nicols)

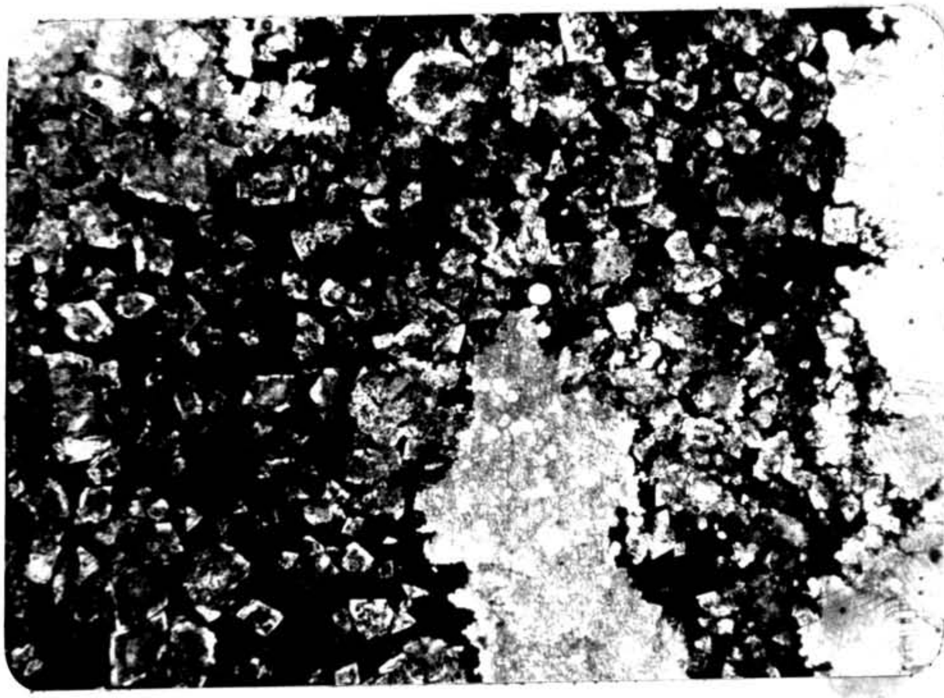


Figure 28 Photomicrograph of light gray limestone showing relatively strong mineralization and both calcite matrix and crystalline masses appear to be intesity replaced by dolomite. (Thin section, 40 x, crossed nicols)

of dark gray patches which are composed mainly of cryptocrystalline lime mud and carbonaceous material.

Petrographically, the unit is, texturally, wackstone to packstone (Dunham, 1962) or pelbiosparite (Folk, 1968). Some bioclastic components are entirely recrystallized and filled up with coarse-grained calcite and dolomite. In contrast, some clastic components which are probable stretched pellet and/or bioclastic fragments of stromatolite (?) and/or coralline algae showing no significant recrystallization. Both of them are cemented by sparry calcite which is, in places, subsequently replaced by dolomite. Fine-grained pyrite is always disseminated throughout the rock. Galena and sphalerite occurring as tiny lenticular bodies parallel to the bedding is not uncommon.

3.3 The Dark Gray Limestone

The unit is usually very dark gray to black, laminated to very thinly-bedded biomicrite (Folk, 1968). The bedding plane is commonly defined by intercalated argillaceous films which are usually less than 1 mm thick. In places, numerous calcite veins occur cutting across the limestone.

Petrographically, the texture of the dark gray limestone varies from wackstone to packstone (Dunham, 1962). Bioclasts are composed predominantly of algal boring tube and, probably, coralline algal (Figure 29). The interskeletal spaces are commonly occupied by dolomitized crystalline calcite (Figure 30). It is noteworthy

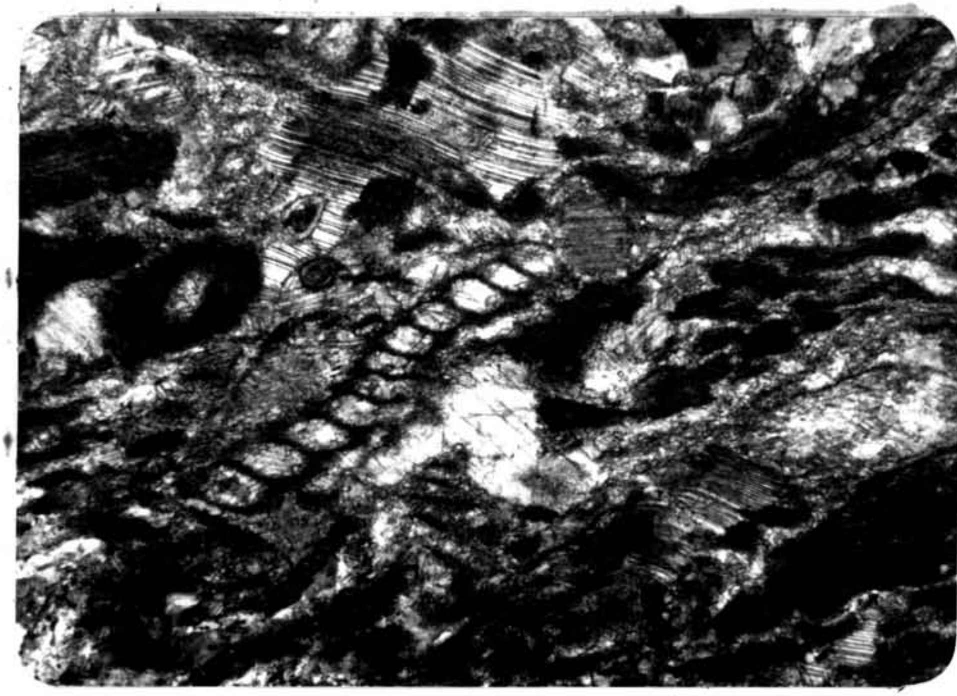


Figure 29 Photomicrograph of dark gray limestone showing bioclasts of algal boring tube and probably coralline algal. (Thin section, 40 x, crossed nicols)

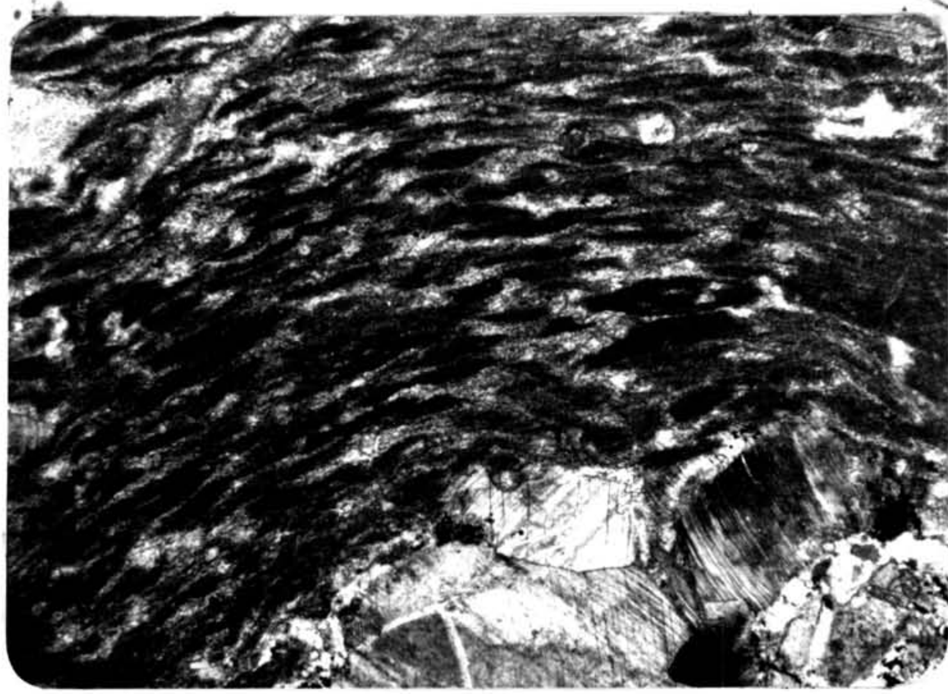


Figure 30 Photomicrograph of dark gray limestone showing interskeletal spaces commonly occupied by dolomitized crystalline calcite. (Thin section, 40 x, crossed nicols)

to point out that most organic-shaped grains are completely replaced by sparry calcite (Figure 31). In addition, fine-grained euhedral pyrite and minor ore irregularly disseminated throughout the rock.

3.4 <u>Interrelationship of the Limestones</u>

Kuchelka (1981) indicated that the thickness of the light gray limestone units commonly varies from 5 to 50 m thick occurring as intercalated layers in the dark limestones. However, on the basis of a close examination the lithologic sequence of the Song Toh mine (Figure 25), it is interesting to note that they seem to indicate at least three cycles of sedmentation. Each cycle predominantly starts with gray limestone, light gray limestone, interbeded light gray and gray limestone and finally dark gray limestone. Moreover, recent evidence observed from newly developed underground exposures indicates that the light gray limestone exhibits a complicated relationship with the other two gray units. Laterally, the light gray rocks change into the gray or dark gray units with interdigitation contact (Figure 32). In vertical sense, the light gray rocks usually show a sharp and a gradational interface with the gray units (Figure 33 and 34). Moreover, the light gray units are usually tongue-shaped with their horizontal length usually less than 350 m.

From the lithological and paleontological point of view the whole carbonate sequence is characterized by abundant remains of algal boring tube and stromatoporoids. Furthermore, the limestone

Figure 31 Photomicrograph of dark gray limestone showing some organic-shaped bioclasts completely replaced by sparry calcite.
(Thin section, 40 x, crossed nicols)

Figure 32 Showing laterally facies-change contact between dark gray limestone and light gray limestone.
(Song Toh South mine, + 608 m level)

Figure 33 Showing vertically sharp contact between dark gray limestone and light gray limestone.
(Song Toh South mine, + 612 m level)

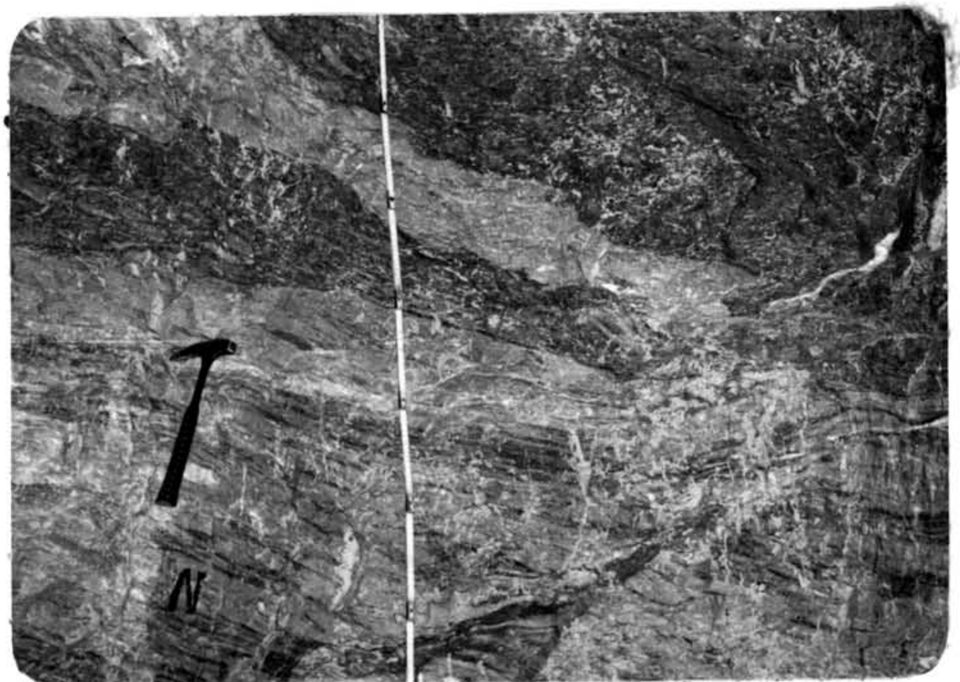


Figure 34 Showing vertically gradational change between light gray and gray limestone.
(Song Toh South mine, + 620 m level)

units are well-laminated to thinly-bedded. All features referred to are indicative of deposition in shallow water environment.