CHAPTER V

DISCUSSION

The problem of the origin of the Song Toh mineralization remains unsolved, despite the possibility of a syngenetic has already been suggested by Koch in 1973. There are a number of features of the Song Toh geology and ores which may have been cited as evidences for varying ore origins. Therefore it is desirable to consider these features since most of the evidences dissolves into ambiguity on careful examination.

1. Host Rock Character and Alteration

By far the majority of known deposits of the Song Toh ores occur within sedimentary carbonate units. There is strong evidence paleontologically and lithologically indicates that the enclosing carbonate sediments have been laid down not far from a shoreline. The associated carbonate rocks may presumably form part of a reef, i.e., it is biohermal (Sander and Friedman, 1967). Though the rock may be genuine limestone, magnesian limestone, probably due to subsequent dolomitization, is the most characteristic host. It is of importance to point out that certain stratigraphic horizons appear to be the principal producers, but mineralization - particularly of the low grade ores - extends over a large stratigraphic interval. Apart from the recrystallization of the limestone and ubiquituous occurrence of

dolomite and minor jasperoid, hydrothermal wall-rock alteration is generally insignificant. This phenomenon can be utilized by some workers in support of a syngenetic origin. However, Friedman and Sander (1967) suggested that, regardless of what factors were responsible for the locallization of the masses of dolomite, it appears that the solutions responsible for dolomitization were brines.

2. Conformability

In the Song Toh area, the main lode-horizons and minor ore showings appear, in general, conformable with the prominant bedding, foliation and/or lineation of the enclosing carbonate rocks. Emphasis has frequently been placed on this apparent conformability by exponents of recent theories of sedimentary origin. Of particular noteworthy is the stratified feature of the Song Toh ores, to many geologists, for examples Bain (1960) and Stanton (1972), indicated that the stratiform bodies are less likely to have been formed by ore fluids introduced into the rock after lithification than to have been initially incorporated in the primary sediments at the same time as these were laid down. However, there are widespread occurrences of the so-called flaser ores and ore-breccias scattered throughout the lode-horizons in the Song Toh mine, these ore types are frequently interpreted to be solutional collapse breccias many of which may have been initially developed along fractures by ground water related to erosional surfaces, and the process may have been continued by ore fluids (Bernard,1973; Hagni,1976). Consequently, while those parts of the Song Toh ores that are stratiform may be sedimentary in their present form,

those that occur in interclastic spaces and cavities are manifestly introduced at least on a small scale.

3. Ore Localization in Relation to the Regional Setting

The Song Toh mineralization is localized on the eastern limb of an anticline forming part of a complex fold structures. Although there are two sets of faults can be recognized in the mine area, on the basis of their cross-cutting relationship to the orebodies and related country rocks indicates that all of these faults are post-mineralization. It is of interesting to emphasize here that whatever the primary origin of the ore were, in so far the lode horizons are concordant with the sediments, the ore-wallrock associations provide very little cross-cutting evidence of relative age. Furthermore, in zones of folding the orebodies exhibit the same contortions of form characteristic of the structurally deformed country rocks. Consequently, the deformational features preserved in the Song Toh ores on both megascopic and microscopic scale represent convincing evidence that the Song Toh orebodies have undergone concomitant tectonic deformation with the enclosing host rocks.

4. Mineralogy

The mineral constituents of the Song Toh mineralization are principally restricted to a small number including galena, pyrite, sphalerite, calcite, and dolomite. Though sericite, quartz, barite, hematite, boulangerite and cerussite are not uncommon, they are

generally present in minor or trace amounts. Therefore it is interesting to note that the principal minerals are simple sulfides, and carbonate with having simple chemical compositions. Chemically, the major elemental constituents in the ores are : Pb,Fe,Ca,Mg,Zn,S,C, O,Si, and Ba with minor amounts of Ag and Hg. The last two elements might be present partly in the sulfosalts.

Another noteworthy ore character is the occurrence of sphalerite which is consistently in light colour with low iron content suggesting that the Song Toh mineralization may have been deposited from a very low temperature ore-solution (Barton and Toulmin, 1966; and Scott and Kissin, 1973). Moreover, the morphology and textural relations of the sulfides and associated minerals vary with the small-scale form of the occurrence. In a broad sense, the precise grain boundaries are commonly referred to as those of polycrystalline aggregates with nonequilibrium and impringement character of which may be attested by the microspherical bodies of colloform and framboidal pyrite (Stanton,1972). These framboids occur throughout the lode horizons and no pseudomorphism of the framboids by other sulfides has been observed. However, many of them have notably become modified further by overgrowths of radial aggregates of crystalline pyrites. In general, the spheroidal form of framboids has been attributed to a gel stage by both biological and abiological means in the formation of metastable iron-sulfides (probably, mackinawite or greigite) which have subsequently been transformed to pyrite by the pyritization process. The process is considered to be of early

diagenetic origin (Love and Amstutz, 1966 ; Kalliokoski, 1966 ; and Sweeny and Kaplan, 1973).

Another notable feature of the Song Toh ores is the sub-structure developed in galena suggesting that galena may have acquired a preferred orientation during the deformation at low temperatures, which may have been removed by annealing at higher temperatures through recrystallization (Stanton 1964 ; Stanton and Willey, 1970, 1971, 1972; and Siemes, 1976). Therefore, those pieces of the foregoing evidence appear to lend a support to the syngenetic ore genesis. Nonetheless, Schulz (1976) pointed out that conformability of internal stratified ores and host rock only indicates that no displacement of strata before internal apposition tock place.

5. Igneous Rock Source

Though several masses of granitoid rocks are exposed at the surface around the Song Toh area, on the basis of field evidence, Koch (1973) indicated that their relative age may probably be late Permo-Triassic or younger. The granitoid rocks may have been emplaced during and/or after the tectonic deformational event of the orebodies and host rocks. Therefore it is reasonable to point out that these granitoid rocks are not genitically associated with the Song Toh mineralization. Furthermore, the evidence from a detailed mapping in the mine area carried out by the present study indicates the absence of wall-rock alteration together with a failure to locate any igneous source. This notable observation can be cited for a

possible evidence against a magmatic ore origin. However, it is still, an inconclusive evidence as the postulated parent igneous source may never be exposed.