A STUDY
of
TATLAYOKO LAKE ORE.
by

Hughie Livingstone

Geology 9 1943

(9)

ACKNOWLEDGEMENT

The author wishes to acknowledge the able direction of Dr. H.V. Warren, Associate Professor of Mineralogy and Petrography, in whose classes this work was done.

OBJECT---

The purpose of this study of polished sections from the Morris Group was to determine if the arseno pyrite and the stibnite were interlocked and secondly to see if these two were amenable to separation by crushing and grinding.

SUMMARY OF CONCLUSIONS.

The study of these sections showed that the stibnite and the arseno pyrite are not interlocked with each other. They could be separated by a crushing and grinding system. That the separation of stibnite from tetrahedrite will be difficult,as they are intimately locked with each other. The gold observed was associated with the gangue rather than with the arseno pyrite as is stated in the Annual Report of the Minister of Mines of British Columbia (1935).

MORRIS GROUP - TATLAYOKO LAKE

HISTORY

This group of claims was discovered from vein-outcroppings by I.T. Morris who with A.H. Sheppard staked claims. Tatlayoko Gold Mines Limited aquired title to the claims in 1909. Two years later the claims were crown-granted. The property lay idle from 1912 to 1920 when M. Sutton aquired Sheppard's interests. In 1921 operations were started, lumber was sawn for camp buildings, and a road into the power plant site was built. Bridge Island Golds Limited assumed control of operations in 1934. Little mining of any consequences had been done in the period from 1912 to 1934. Extensive surface workings, (clearing and trenching) however, have been carried out. A cross-cut has been driven, for a short distance, the No. 1 leading to the main vein, and the No. 2 following a small quartz vein in argillite.

LOCATION.

The property is situated 3 miles south-east of the south end of Tatlayoko lake, near the eastern boundary of now Clinton ← ~~Nanaimo~~ Mining Division. The base camp is situated on Mathews Creek some 900 feet from the workings. This area is some 169 miles by motor road from the town of Williams Lake in a westerly direction. The road into the mine is quite passible in dry weather. The property (base camp) is also accessible by light truck from the southern landing of Tatlayoko Lake by a road 3½ miles in length. The mine is at an elevation of 6,050 feet.

GEOLOGY.

The author has not seen this property nor visited this district but both the location and geology have been taken from the "Annual Report of the Minister of Mines of British Columbia", 1935. The geology of the area is admirably given in an extract from the "Geological Survey of Canada Summary Report", Part A, 1924, page 70:---"The veins cut Triassic sediments, chiefly argillites, and fine sandstones, but with one thin bed of fine cherty conglomerate. A short distance northeast of the veins is a stock of quartz diorite probably related to the Coast Range batholith, the edge of which is situated a few miles to the south. Many dykes cut the sediments and range in composition from diorite to basalt. Many, if not all of them are younger than the veins, since they cut the veins or cut other dykes which cut the veins. One basalt dyke follows the main veing through its length, crossing it and recrossing it, and holding included fragments of it."

In the Minister of Mines Report, the following is of considerable interest, "Within this area are exposed numerous veins, stringers and lenses which are associated with fissures or fractures cutting the formation in various directions. No definite system of fracturing was observed, and strikes and dips vary very considerably -- In several cases within the sedimentary formation veins follow one or both walls of dykes".

POLISHED SECTIONS.

Preparation.

The ore consisted of half a dozen lumps about the size of a fist. Of these, three typical ones were selected as a fair representation of the suite. Three adjacent slices were cut from each of these lumps by a diamond saw. The middle slice being used as the section the others were kept as references. The middle slice was cut down to a size to fit the brass holding boxes, and then mounted in demar gum. These specimens were then hand polished in the usual manner. The samples thus made were fairly representative, number one being very rich in stibnite, number two being only mediocre, while number three was a section from the wallrock adjacent to the vein.

DESCRIPTION.

Specimen No. 1 - Stibnite rich.

The following minerals were identified and confirmed. These minerals in their order of abundance, are quartz, (two types), stibnite, arseno pyrite, tetrahedrite, pyrite, calcite, gold.

There are two types of quartz in this sample, one quite dark and the other almost clear in colour. The whole sample is thoroughly fractured with fissures without any apparent system. The lighter quartz and the stibnite appear to have filled in part some of these fissures. The tetrahedrite is thoroughly inter-locked with the stibnite, being only slightly darker in colour than the stibnite. (see plates (1) and (4).) This was confirmed by running micro-chemical test on specks scratched out of the darker mineral, these tests giving positive results for both antimony and copper. Stibnite was more abundant however, and K O H etch test would often mask the tetrahedrite. The pyrite was present only as small inclusions within the arseno pyrite, probably due to a lack of arsenic upon cooling. A little calcite was found but this was very small. Small specks of gold were found, although only 1-2 microns in size. This gold was only found in the second type of quartz. The arseno pyrite was found in its characteristic crystal forms of diamonds and rectangles. Some of these were perfectly formed others being very rough and broken up as shown in plates (1) and (3).

Specimen No. 2 - Ordinary Ore.

The following minerals were indentified and given in the order of predominance, are, quartz, stibnite and arseno pyrite, tetrahedrite, pyrite and other inclusions in the arseno pyrites and one or two isolated crystals of pyrite. One speck of gold was observed in this specimen.

There are fissures and fractures every where in this specimen. The stibnite and quartz are undoubtably filling these fractures and fissures as is illustrated in plate 3. This plate also shows that the quartz is attacking the crystals of arseno pyrite. These tongues of quartz eating the arseno pyrites are often lined with tiny crystals of pyrite.

Specimen No. 3.- Wall-rock.

This specimen was nearly all quartz and altered wall rock, arseno pyrite was more in abundance than stibnite. These two were quite abundant on the vein side of the specimen, however, small crystals of arseno pyrite varying from 2 - 20 microns were widely disseminated throughout the whole specimen, and the fissures and fractures were closely associated around these crystals. In this specimen there wasn't the same tendency of the arseno pyrite to be eaten away at the edges. The crystals being for the most part fairly perfect diamonds and rectangles. The tetrahedrite and stibnite separation was a little more definite than that of specimen No. 1, this fact can be seen by comparing plate four with plate one. In plate four the boundary is fairly smooth while that shown in plate one is very irregular, the tongues of tetrahedrite running into the stibnite. Pyrite inclusions could also be observed in arseno pyrite, these were like rosettes. Calcite was found only in small amounts. A new mineral makes its appearance in this specimen. This mineral was identified by its honey colour under the arc light assphalerite. Sphalerite was only present in pin-point specks.

PARAGENISIS.

From observation of polished sections the author believes that the deposition of the quartz came first. This was followed closely, if not at the same time, by arseno pyrite. These two were allowed to cool slowly. This slow cooling period is confirmed by the large, distinct crystals of arseno pyrite that have percipitated, in the diamond and rectangular forms which are common to arseno pyrites under favourable conditions. This fact is further substantiated by the presence of small inclusions of pyrite (rosettes). These were in all probability caused by an insufficient amount of arsenic present thus $Fe\ AsS_2$ became FeS_2. Some time after this considerable movement has undoubtedly taken place. Each specimen is intricately laced with fractures and fissures without any apparent system. A second generation of quartz came through from the magma. This new quartz or gangue shows a great tendency to eat the edges of the arseno pyrite, this is shown distinctly in plate 3. That two generations of quartz are present is shown by the difference in coloring of the gangue (plate 5). This second quartz then received a sudden chill and small fissures developed, and through these fissures the stibnite was deposited. This statement is borne out by the fact that the stibnite has flowed around the crystals of arseno pyrite, thus the stibnite often has small inclusions of arseno pyrite (plate 5). Tetrahedrite must have appeared at the same time, for the stibnite and tetrahedrite are to all appearances, intimately interlocked with each other. There are little or no boundaries between these two minerals proving that they were deposited more or less contemporaneously.

The deposition of both pyrite and sphalerite occurred with the second generation of the quartz. Both these sulphides are small in amounts. The gold observed in specimen No. 1 was found in this latter quartz and oould in no way be seen to associate with the arseno pyrites as is stated in the Minister of Mines Report (1935).

DISCUSSION:

It was quite evident from the study of the polished sections that except for a few cases the arseno pyrite and the stibnite were not locked and would be quite amenable to crushing and grinding. To the author the main problem arising from the study of these sections becomes one of mineral dressing. There are six minerals to contend with, stibnite, tetrahedrite, arseno pyrite, pyrite, gold and silver. To float these minerals, the first two will float with little or no trouble, arseno pyrite whose flotation characteristics are similar to chalcopyrite, can be depressed, with the pyrites. But this brings up the problem of the separation of the stibnite and tetrahedrite. The specific gravity of these two minerals are really the same and this eliminates any possibility of a gravity separation. If, however, selective flotation of these two minerals can be made to work, a marketable antimony concentrate can be prepared. But the draw back to this method is that gold and silver values carried in the stibnite are lost, as smelters will not pay for them if in antimony. The arseno pyrite and pyrite should yield good values in gold and silver if treatment takes place at the mine site. Transportation difficulties make it impracticle to ship ~~such~~ a large concentrate.

There was not enough gold observed in the specimens to state definitely just where its association lay. That studied, however, was in the gangue, if this is true for the greater percentage of the values, then concentration of gold becomes relatively simple.

Tatlayoko Lake Ore

Morris Group.

blue -- first generation quartz

light grey -- second generation quartz

dark grey -- fissures and cracks

white -- crystals of arsenopyrites

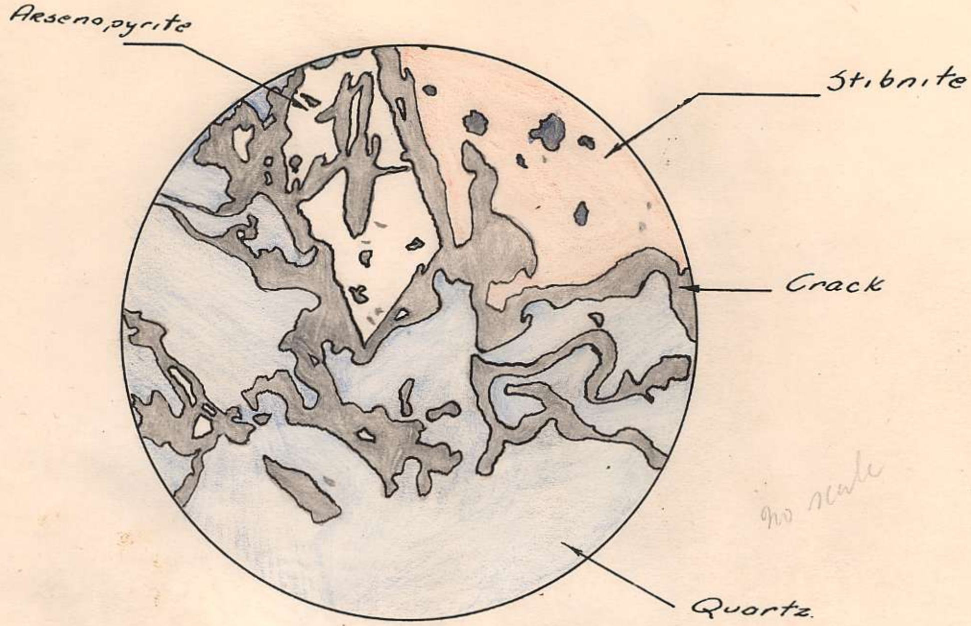
tan -- stibnite

green -- tetrahedrite

Note:

The irregularity of the tetrahedrite in the stibnite. These two are thoroughly interlocked.

Plate II



Tatlayoko Lake Ore

Morris Group.

blue-- quartz

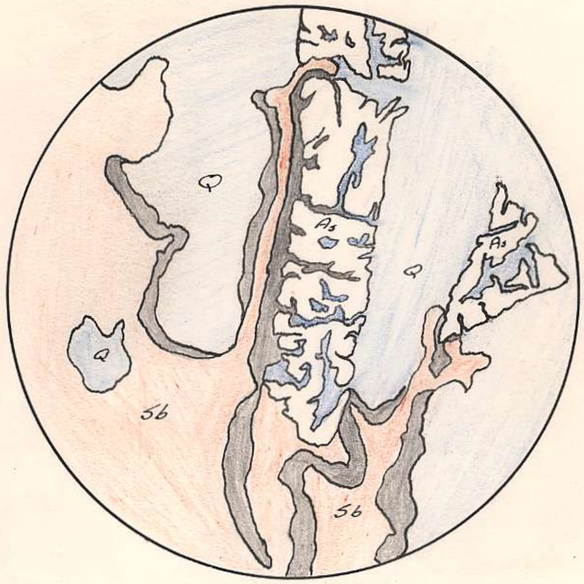
tan -- stibnite

white --- crystals of arsenopyrite

dark grey -- cracks and fissures

Note the way the crystals of arsenopyrites have been eaten away. The stibnite appears to be filling up the fissures.

Plate III



Tatlayoko Lake Ore

Morris Group.

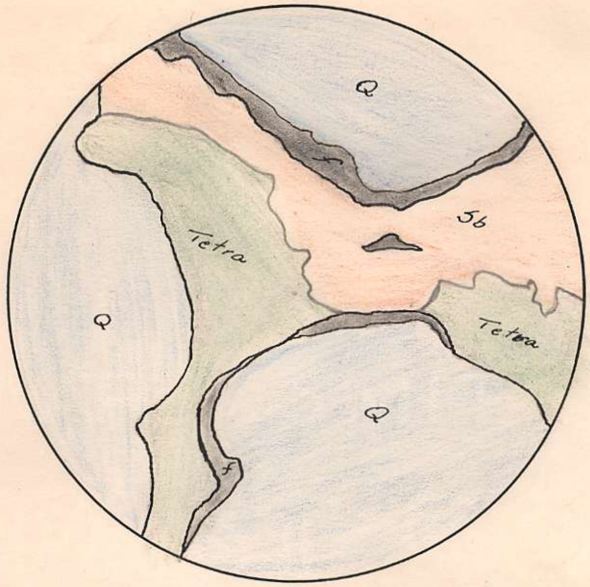
blue -- quartz

tan -- stibnite

white --arsenopyrite

dark grey-- cracks and fissures

Note how the crystals of arsenopyrites have been eaten away and the quartz and stibnite are replacing those parts . This also shows that the stibnite is filling in the cracks.



Tatlayoko Lake Ore
Morris Group.

blue -- quartz

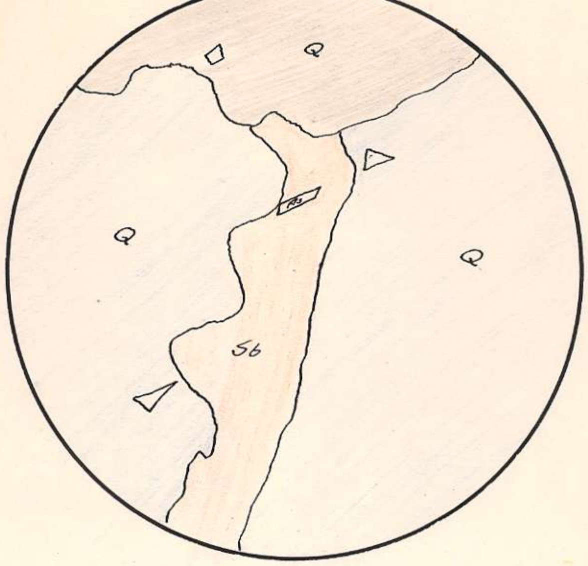
Tan -- stibnite

green -- tetrahedrite

dark grey -- fissures and cracks

The tetrahedrite and stibnite are interlocked.

Plate V



Tatlayoko Lake Ore

Morris Group.

blue -- first generation quartz

grey -- second generation quartz

Tan -- stibnite

white -- crystals of arsenopyrites

The stibnite has flown around the arsenopyrites and the arsenopyrite now appears as inclusions. This is also true in the case of the second generation quartz