A MICROSCOPIC STUDY OF ORES FROM NICOLA MINE

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FOREWORD

This report is an attempt to present a description of the mineralogy and paragenesis of the ore minerals at the Nicola Mines. The work was carried out during the Spring Term of 1941. It consisted of cutting, mounting, and polishing selected specimens from various parts of the workings, then examining them under the microscope. Both etch tests and micro-chemical methods aided the determinations. The writer wishes to express his appreciation to Dr. H. V. Warren as well as Messrs. A. R. Allen and C. S. Ney for their kind assistance and valuable instruction.

LOCATION

Nicola Mines & Metals Ltd., as it is now known, control a group of 26 claims, some of which embrace the King William and Enterprise veins. The mill and mine workings are located on Mineral Hill at Stump Lake, about 30 miles east of Merritt, in the Yale Mining Division. The properties may be reached by a short branch road off the Merritt-Kamloops Highway.

HISTORY

Claims were first staked on Mineral Hill around 1883. A few years later, both the Nicola Mining & Milling Co., and the Star Mining Co. did subsurface work, the latter concern erecting a small concentrator. The ground lay idle until 1916, when another group took control, and built a small mill. However, they shipped a very few tons and again the property was abandoned until 1925. This time the Planet Mines & Reduction Co., of Nicola, Ltd., were more successful, but even so, after developing a crosscut and extending the shaft besides building an 80-ton mill, operations ceased in 1931 when the ore became too low in grade. The present operators, Nicola Mines & Metals, Ltd., have been more fortunate, and since they took over, with the exception of a few months, operations have been continuous since 1933.

GEOLOGY (REGIONAL)

In this district, the Nicola Formation is the country rock. It is made up of altered volcanics of andesitic composition as well as localized variations of coarse-grained diabase. The whole has been altered in varying degrees to greenstone due to chloritization. Near the main veins, the bedding is almost standing on end, and strikes about south-west. Andesite dykes of variable width cut the veins.

GEOLOGY (ECONOMIC)

Quartz veins,which are irregularly mineralized with sulphides are found in fracture zones in the diabase. The veins strike anywhere from N 45° W tb N 25° E , and the dip varjes from vertical to 45°. Besides, they pinch and swell from a few inches up to over four feet.

Hydrothermal alteration has sericitized and pyritized the wa wall-rock for nearly ten feet on either side of the veins.

MINERALOGY

POLISHED SECTIONS

The following is a list of sections made up from Nicola ore:

No. 1	Enterprise vein	320 level	#21 stope
No. 2	Enterprise vein	540 level	Hanging wall by track below #9 stope.
No. 3	North Enterprise vein	675 level	
No. 4	Enterprise vein	440 level	#9 stope
No. 5	Enterprise vein	440 level	#9 stope
No. 6	King William vein	675 level	#14 2d stope
No. 7	King William vein	4N crosscut.	

Some salient features of these sections as seen under the microscope, are sketched on pp. none for copy On p. 4, the sections are described both macroscopically and microscopically.

No. 1 SECTION

Shattered pyrite in fractured milky quartz together make up almost 80% of the specimen. About 15% consists of sphalerite with unmixed chalcopyrite and fragments of included pyrite. Both zinc blende and galena rim and vein the iron sulphide mineral, the latter doing so in an exceedingly irregular and angular fashion. Late quartz cuts sphalerite in tiny veinlets.

No. 2 SECTION

70% of the specimen consists of white quartz (early phases) which has been fractured and veined. Pyrite is present in fractured masses and rounded grains, while sphalerite is the only other sulphide present in fairly large amounts. An extremely bunchy veinlet of galena is found in quartz, while the later phases of this gangue knife a mass of sphalerite in irregular gashes.

No. 3 SECTION

Sphalerite is the major sulphide present here, and has partly engulfed along its borders, some grains of pyrite. Also intimately associated are irregular masses of galena, which in turn have particles of sphalerite enclosed. There is a wavy crude banding of pyrite grains, some of them being rimmed with chalcopyrite.

No. 4 Section

Pyrite, which makes up over 60% of this section, occurs mostly as clusters of individual rounded grains. They are either in quartz, surrounded and veined by chalcopyrite, or rimmed and penetrated by galena. Larger than usual amounts of chalcopyrite are present. This mineral is in deeply embayed clots in galena, as well as veins and shells closely associated with pyrite.

No. 5 SECTION

Pyrite is irregularly and extensively fractured then veined with sphalerite, chalcopyrite, and finally galena. Milky quartz has also been fractured, and healed by short uneven veinlets of galena. The same mineral also veins chalcopyrite.

No. 6 SECTION

Extensive veining by galena has healed many fractures in the pyrite, incorporating small amounts of that mineral. This is the only section in which pyrrhotite has been observed. It occurs in irregular masses, intimately associated with both galena and chalcopyrite, as shown in accompanying sketch.

No. 7 SECTION

Milky quartz constitutes over 70% of this speciment Pyrite makes up about 20%, and occurs as fairly solid grains with almost crystal outlines. Sphalerite has rather deeply embayed contacts with pyrite. Galena veinlets have healed quartz fractures.

MINERALS

PYRITE

This is the most abundant mineral in the suite, comprising at least 50% of the ore. It occurs as large irregular crushed masses, and rounded massive grains with a tendency in some cases towards a crystal outline. The fractures have been healed by galena, sphalerite, and chalcopyrite, as well as late phases of quartz. In all likelihood then, pyrite was the first sulphide to be deposited.

SPHALERITE

This mineral occurs as irregular masses ~~of~~ in quartz, as smaller inclusions in galena, and as interstitial material in pyrite. Almost invariably it holds a very close relationship to chalcopyrite, indicating that it was brought in either contemporaneously or slightly earlier than this sulphide. The boundaries between the two are usually smooth. Besides, the sphalerite is shot through myriads myriads of small rounded blebs of chalcopyrite.

CHALCOPYRITE

This sulphide is not so common in the Nicola ore. It occurs in galena as irregular deeply embayed masses, and also as minute ~~b~~lebs in sphalerite. This small particles vary greatly both in shape and in size. There is a tendency for them to be concentrated near pyrite boundaries, but a definite relation was not seen. In other cases, the particles, which are due to exsolution from the sphalerite, seemed to follow definite lines, quite similar to sphalerite cleavage faces.

GALENA

It occurs in local concentrations and in irregular veinlets. As mentioned above, chalcopyrite is incorporated in it. It veins sphalerite, and quartz more frequently, and is possibly one of the latest, if not the latest sulphide to be deposited.

PYRRHOTITE

As mentioned before, this mineral was found in only one section, (No. 6). Its colour had a pinkish tinge, and it stood out from the other sulphides. The amount present is very small, and the shape is very irregular. From its association, it may possibly be later than the chalcopyrite, and earlier than the galena.

QUARTZ

As may be expected, this gangue constitutes an important amount of the ore. Al though siliceous deposition was predominant both at the very early and verylate stages of mineralization, it is doubtful whether two distinct generations of quartz exist. The mineral is generally milky, badly fractured and veined. The later phases tend to be clearer and darker under the microscope, and even approach in a few cases, the crystalline form.

GOLD

On several occasions, especially in specimens from the King William vein, small blebby masses of chalcopyrite were mistaken for gold. However, on application of potassium cyanide, the characteristic black tarnish did not evince itself. No gold was seen, either in the hand specimens or the polished sections.

PARAGENESIS

From the above evidence, it may be stated with a fair degree of assurance, that pyrite was the first sulphide to be deposited in the veins at Nicola. However the relation of this mineral with chalcopyrite may raise some doubts. Was chalcopyrite introduced into the fractures in pyrite by the same pressure that caused them, or did these two sulphides come in contemporaneously, the pyrite being pseudomorphous after carbonates which it had replaced?

The question of chalcopyrite and sphalerite is perhaps a difficult one, but it is believed from this study, that if anything, the chalcopyrite is a little later the zinc blende. Pyrrhotite, on account of its occurrence, should be next in line. With smooth borders next ot chalcopyrite, and contacting galena in a very irregular line, it may be the fourth sulphide to be brought in.

After some fracturing took place, it is very likely that galena was deposited, both in fractures and masses.

As previously stated, there were two periods when infiltration of silica was predominant, at the beginning of mineralization, and in the late phases. The bulk of the quartz came from these two, but there is a possibility that the gangue, in small quantities, was introduced throughout the ore-forming period.

TABLE OF PARAGENESIS

In view of the evidence cited above, a tentative schedule showing the relations in time, of the different minerals found in the suite of ores from the Nicola Mine, has been drawn up. The black lines indicate the period at which it is thought the mineral was being deposited.

QUARTZ ———— - - - - - ——

PYRITE ————

SPHALERITE ————

CHALCOPYRITE ————

PYRRHOTITE ————

GALENA ————

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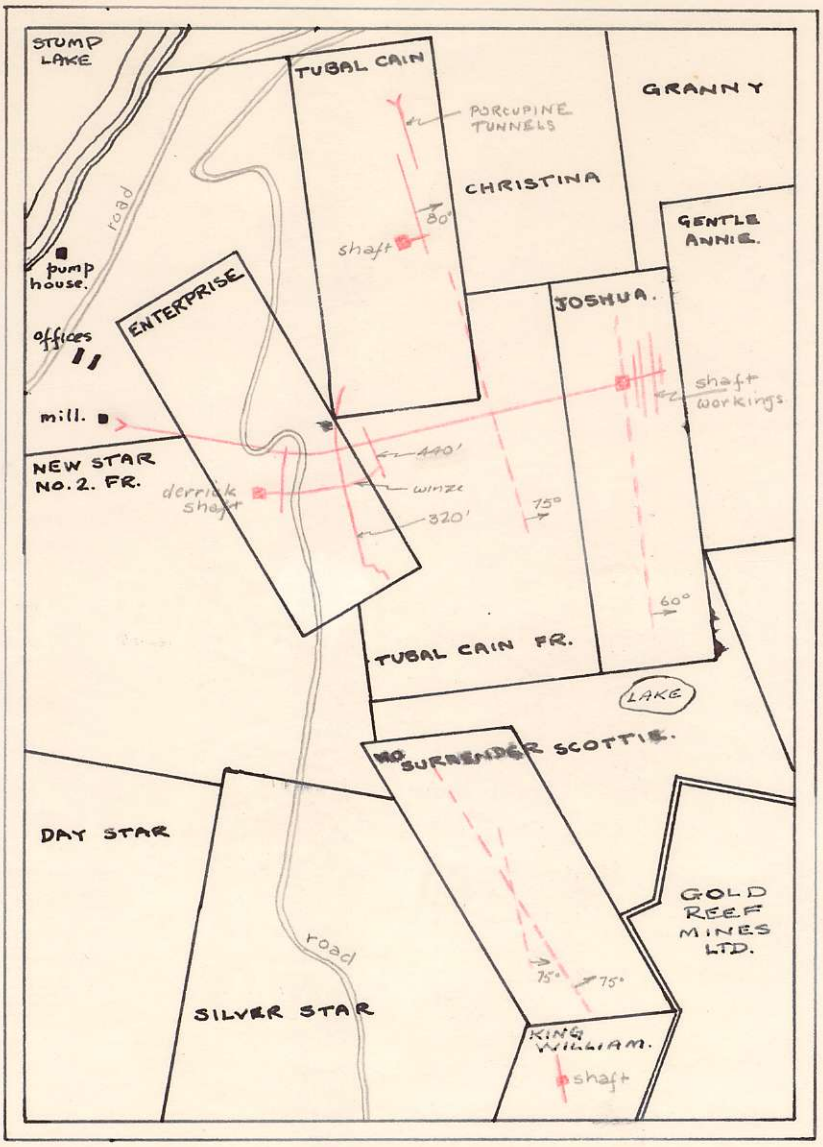

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SCALE.

0 2,000

feet.

Mine workings shown in red,

veins in broken lines.