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Report on Microscopic Study of Ores of the Reno Mine

by

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December 1937.

ACKNOWLEDGEMENT

The author wishes to thank Dr. Warren of the Department of Geology, under whose supervision this report was made, for his many valuable suggestions and timely criticisms.

OUTLINE

LOCATION

The Reno Mine is at the head of Fawn Creek, a tributary of Sheep Creek, on the west slope of Reno Mountain. The mine camp is reached by a 16 mile motor road from Salmo, a town on the Great Northern Railroad, 28 miles south-west of Nelson.

GENERAL GEOLOGY

The Reno Mine is in the Sheep Creek district of the Nelson Mining division. This district lies on the western slope of the Quartzite, or Nelson, Range of the Selkirk Mountain system.

The more important formations, in descending order of age, in this area consist of:

1. The Pend d'Oreille series of Late Pre-Cambrian age, composed of phyllite, argillaceous quartzite, and limestene.

2. Reno Formation of Late Pre-Cambrian age, composed of quartzites, limestone and argillaceous quartzite.

3. The Quartzite Range formation of Late Pre-Cambrian Age, composed of quartzite, argillaceous quartzite and argillite member.

This range is sub-divided into 2 sections; the Motherlode quartzites to the east and the Nugget quartzites to the west, with a separating band of schist.

MINE GEOLOGY

The present conception of the Reno vein system is that of a main fissure striking approximately N70 E, with spur fissures or splits on either side running N85° E. Three other veins of strike similar to that of the main vein have been discovered, all to the north of the Reno vein. All dips are close to the vertical, with small variations either way. Well defined walls to the vein are generally lacking, the width of ore being determined by the width of visible mineralization.

PRESENT MILLING METHODS

The present method of treatment is cyanidation, with an overall recovery of 97.5% The flow-sheet includes tabling before fine grinding, thus producing two concentrates, a gold-galena and a sulphide concentrate.

The free gold from the former is amalgamated. As indicated in the sketch for the gold-galena concentrate, this is the best method of treatment, for sufficiently large particles of gold are free to make it economically profitable.

As there are no cyanicide forming minerals in the ore the cyanide consumption should not be unduly high.

DISTRIBUTION OF THE GOLD

Gold occurs whenever pyrrhotite is present, although the values are not necessarily high. It is unusual to find a high gold content unless either sphalerite or galena are also present. According to observation and the accompanying sketches the sphalerite is associated with the gold more often than the galena, and whenever the latter is present sphalerite is also nearby--see section 2, sketch 2.

The assumption may then be made that pyrrhotite is the chief carrier of the gold, followed by sphalerite and galena. Chalcopyrite seems to have no influence on the gold values whatsoever.

Thereare indications that two separate types of gold are present in the Reno Ore. Their locations are unknown, as the difference was not noted until the briquette of the concentrate was examined. One type appeared to be more yellow-brass in color than the other and was at first mistaken for chalcopyrite due to its imperviousness to KCN until the smooth, slick surface was scratched by a sharp needle point. The possibility of a gold-silver alloy, such as electrum, should be thoroughly investigated should any further work be done on this ore.

MINERALOGY SUMMARY

The following minerals were identified and are recorded in order of abundance:

Pyrrhotite
Sphalerite
Galena
Chalcopyrite
Gold

The paragenesis could not be determined definitely, but the probable order is:

Quartz ———————————
Sphalerite ———————————
Chalcopyrite ———————————
Pyrrhotite ———————————
Galena ———————————
Calcite ———————————

DESCRIPTION OF MINERALS

Pyrrhotite($Fe_xS_{x\ 1}$)

Pyrrhotite is the most abundant mineral, both in the specimens and in the mine generally.

It occurs in any proportion in the quartz. Samples vary from solid pyrrhotite to a minute quantity.

Microscopically it was observed that the pyrrhotite was, in the majority of cases, contemporaneous to the sphalerite and chalcopyrite. Little evidence was collected to the contrary, with the exception of one exhibit--10B. This indicated metasomatism of the quartz by the sphalerite and further replacement along the dodecahedral cleavage planes of the sphalerite by the pyrrhotite.

Sphalerite(ZnS)

Sphalerite is a common mineral in the ore examined, ranking next to the pyrrhotite in quantity.

The paragenesis, as previously stated, indicated that sphalerite was deposited by the ascending solutions previous to galena. Its relation to pyrrhotite and chalcopyrite cannot be definitely determined, although section 10B signifies that the galena and pyrrhotite were subsequent. As section 7B shows that the galena came later than the sphalerite the order indicated is - quartz, sphalerite, pyrrhotite, galena, with chalcopyrite in the sphalerite period. The present knowledge concerning the temperature ranges of pyrrhotite and galena also agrees with the placing of the galena later than the pyrrhotite.

Galena(PbS)

While not as plentiful as pyrrhotite and sphalerite the galena is important.

Its presence in the vein seems indicative of higher gold values in the immediate vicinity, although it does not have to be in direct contact with the gold. This was confirmed during the microscopic examination, for it was noticed that, with one exception - #1B, galena was present when gold was found. It is the youngest of the common sulphides present in the ore.

Chalcopyrite($CuFeS_2$)

There appears to be no relation between the chalcopyrite and the gold.

It is the major copper mineral in the ore. Oxidized surfaces of the copper were noticed in several instances, but it is unlikely that the small amount of the oxide of the presence of copper as chalcoprite will retard the recovery of gold or increase the cyanide consumption.

According to the evidence of section 1B it was probably deposited previous to the pyrrhotite and by section 10A also previous to the galena. These are the only facts found regarding its deposition, so nothing can be stated definitely. Most likely ascended at the same time as the sphalerite.

DESCRIPTION OF SECTIONS

SECTION 1B

Composition:
Quartz--60%
Pyrrhotite--35%
Chalcopyrite--5%

Assay: 3.54 oz./ton
Position: #7 Level west

GOLD--No gold is visible in this section. This indicates that the gold must be very finely disseminated, as the assay is 3.64 oz./ton.

There is no doubt that the quartz was previous to all other minerals , followed by chalcopyrite and pyrrhotite. The last two minerals appear to be contemporaneous, as small blebs of chalcopyrite and pyrrhotite are scattered throughout in intimate association without any definite relation to one another.

Although not shown in this sketch it was noticed that in many places on this section a thin edging or layer of chalcopyrite about 5 microns thick surrounded the pyrrhotite. This fact does not disprove the theory of contemporaneous deposition of the two minerals, but rather indicates the possibility of differential cooling with the crystalling of the chalcopyrite on the surace of the pyrrhotite.

Sphalerite was also present but aside from being later than the quartz no further facts could be deduced regarding its paragenesis.

Several small cracks containing calcite were noticed in the section.

SECTION 1A

As this section came from the same specimen as 1B and appeared to be very similar it was not examined in detail. It was noted, however, that it contained a greater percentage of pyrrhotite and correspondingly less chalcopyrite. No gold was visible.

SECTION 7A

Composition:
Quartz: 75%
Sphalerite: 20%
Galena: 5%

Assay: 0.12 oz/ton
Position: 8th Level East

GOLD - Small particles of gold are visible in the sphalerite.

The probable paragenesis was the deposition of the sphalerite and galena in quartz fractures.

There are no indications that the galena and sphalerite are not contemporaneous, and the contacts between the two minerals are very distinct.

The cubic cleavage of galena is clearly shown in several places in the specimen where there is much fracturing, indicating a possible later stress.

Several small particles of chalcopyrite(8 microns in size), were noticed in the galena.

SECTION 7B

Composition:
Quartz: 75%
Sphalerite: 20%
Galena: 5%

Assay: 0.12 oz/ton
Position: 8th Level East

GOLD - Several small particles of gold were noted in the sphalerite as in section 7A.

This section comes from the same specimen as 7A, and is similar in as much as the galena and sphalerite replace the quartz and in the same proportions. There are indications, however that the galena was deposited later than the sphalerite. This is illustrated by the fingers of galena that run into the sphalerite and also the enclosing of the sphalerite by the galena.

When the magnification was increased to 150 it was noticed that the sphalerite contained several small blebs of galena ranging in size from 3-10 microns.

This postulates that there is a possibility of an order of deposition as follows:

1. Sphalerite; galena.
2. Galena and sphalerite; galena.
3. Galena; sphalerite; galena.

As #1 is confirmed in the other sections and follows the usual rule of deposition regulated by temperature it is the most probable of the three.

SECTION 10A

Composition:

Quartz:	70%
Pyrrhotite:	20%
Galena:	5%
Sphalerite:	5%

Assay: High-over 2.0 oz/ton
Position: 6th level centre.

GOLD - Small particles of gold were noted throughout the entire specimen, the majority being associated with the pyrrhotite.

All the minerals seemed contemporaneous and later than the quartz.

SECTION 10B

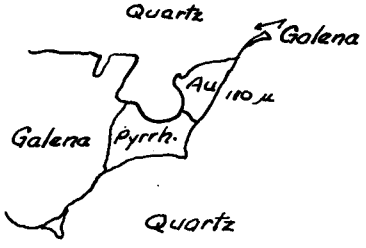
Composition:

Quartz:	60%
Pyrrhotite:	12%
Galena:	8%
Sphalerite:	20%

Assay: High-over 2.0 oz/ton
Position: 6th level centre.

The majority of gold found was in the quartz without any associations, and varying in size from 50 to 90 microns.

Several large particles (100 microns) were found in association with pyrrhotite and galena as typified by the following sketch:



x 35

SECTION 2

Composition:
Quartz: 50%
Sphalerite: 50%

Assay: 30.5 oz/ton
Position: 7th level west.

GOLD - This section was the richest examined, and the microscopic examination confirmed it, although an actual gold count was not made. The average size of the gold was 100 microns. The majority of the gold is in the quartz unassociated with any mineral, or at the quartz-sphalerite contact.

Most of the remaining gold is associated with sphalerite and galena as shown. The gold grain in the sketch is 40 — 80 microns.

Chalcopyrite is present in small amounts on the quartz-sphalerite boundary.

As far as could be determined the three minerals--chalcopyrite, sphalerite and galena were contemporaneous.

SECTION OF GALENA AND GOLD CONCENTRATE FROM WILFLEY TABLE.

Megascopically the concentrate appears to consist only of Gold and Galena with the Galena greatly in excess.

When examined under the microscope the same proportion held, but several additional minerals were noted, namely pyrrhotite, quartz

and one dark unknown mineral.

The pyrrhotite was both free and associated with gold, as shown by the sketch. The presence of the quartz and pyrrhotite indicated that a complete separation was not made, but undoubtedly it was sufficiently complete for all practical purposes.

It was very evident from this concentrate that tabling was justified, as the particles of gold varied from a few microns to 900 in size. The sketched gold grain is 100 microns long and 50-100 wide.

CONCLUSION

There was insufficient time for a conclusive study of the specimens from the Reno Mine, therefore the inferences drawn from the data may not be strictly accurate in all respects.

If a further examination of this ore is made it is recommended that:

1. A careful watch be kept on the gold for the possible types suggested under the heading "Distribution of Gold".

2. A count be made to determine the actual proportional relation of the gold to the various sulphides.

3. A greater number of sections be made to extend the scope for further work on the paragenesis of the minerals.

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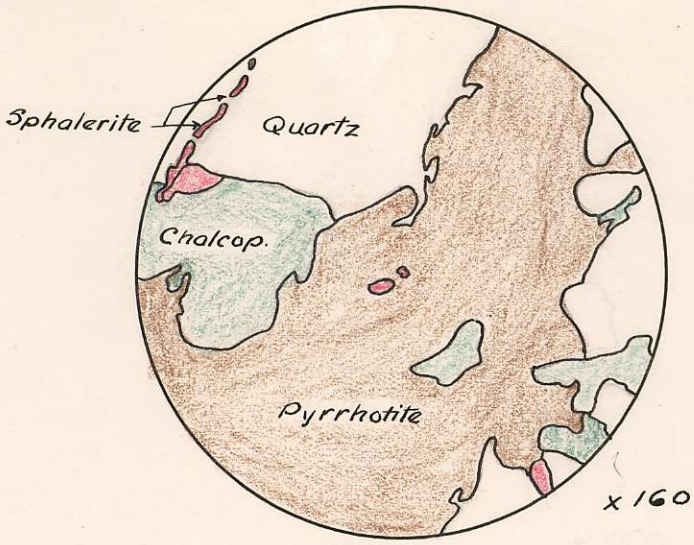

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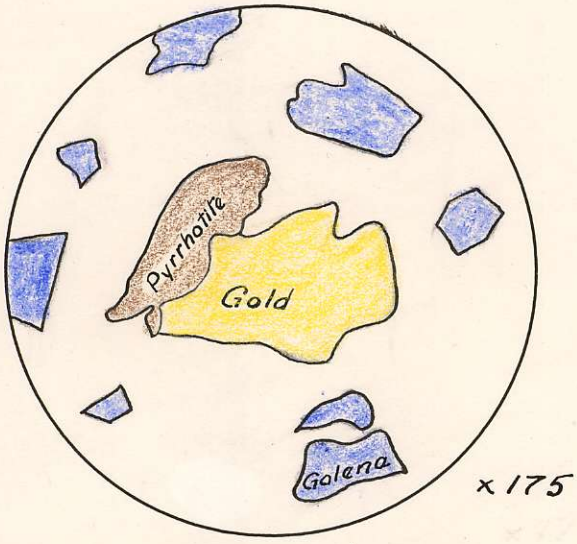
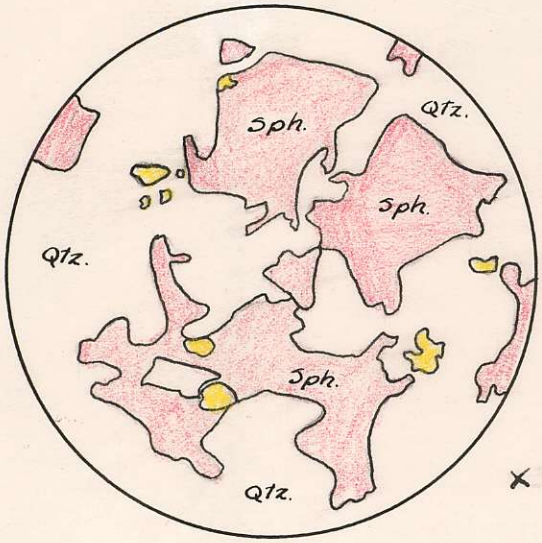
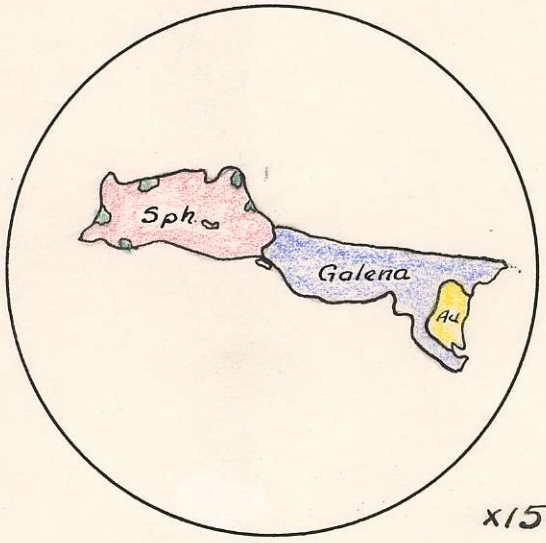


SECTION OF GALENA & GOLD CONCENTRATE



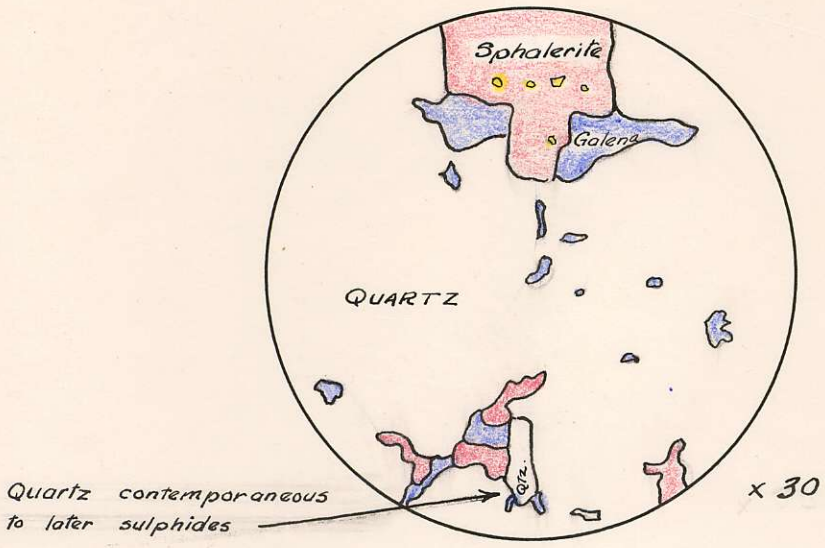
× 35

SECTION 2

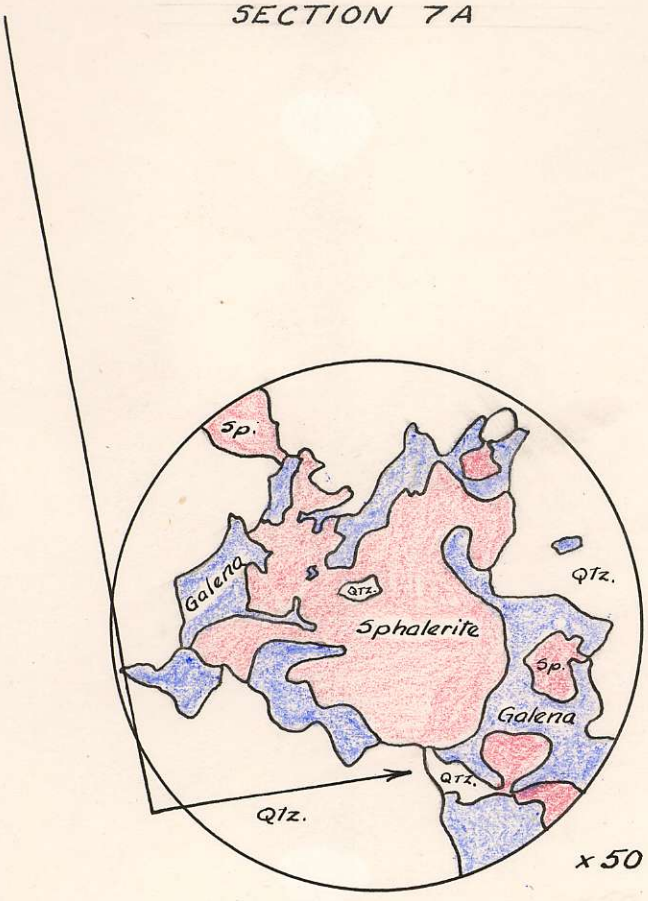


×150

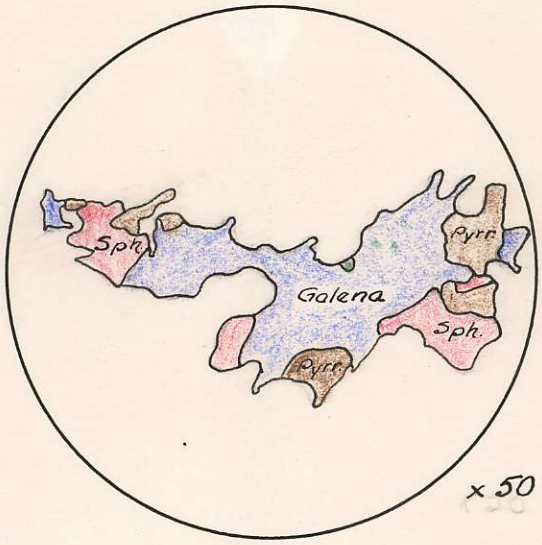
SECTION 2



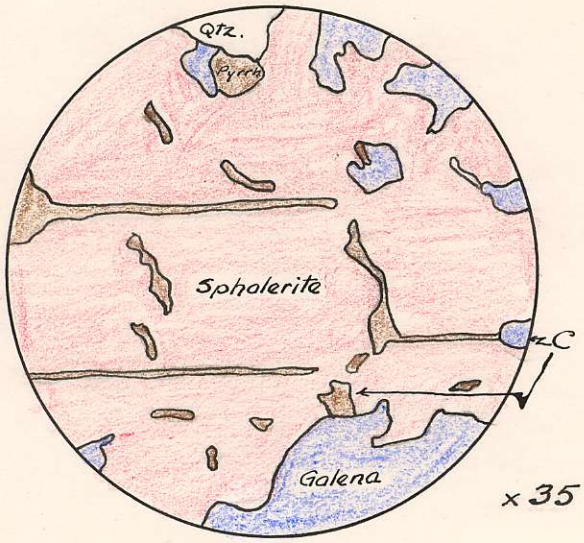
SECTION 7A



SECTION 7B



SECTION 10A



SECTION 10B.