O T T A W A June 3rd, 1940.

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of the

ORE DRESSING AND METALLURGICAL LABORATORIES.

Investigation No. 849.

Microscopic Examination of Samples of Gold Ore
from the Cochenour Willans Gold Mines, Limited,
McKenzie Island, Ontario.

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Shipment:

Seven samples of gold ore and mill products from the Cochenour Willans Gold Mines, Limited, McKenzie Island, Ontario, were received by the Division of Metallic

Minerals, Bureau of Mines, Ottawa, on April 27th, 1940, from Mr. M. G. Smerchanski. They are listed below:

Ore Samples Nos. 1, 2, 3, and 4.
Amalgamation Tailing No. 1.
Flotation Concentrates Nos. 2 and 3.

Purpose:

In a letter dated April 23rd, 1940, Mr. Smerchanski requested the following work carried out on the samples:

(1) Microscopic study of polished sections from the four ore samples for the purpose of determining the sulphides present and their relationship to the introduction of the gold.

(2) Determination of the relationship between the sphalerite in Ore Samples Nos. 3 and 4.

(3) Microscopic examination of Amalgamation Tailing No. 1 and Flotation Concentrate No. 2, presumably for the purpose of determining the mode of occurrence of the gold.

(4) Quantitative chemical determination of the sulphur and arsenic in Flotation Concentrate No. 3.

Extra: Additional determinations of antimony, copper and zinc were requested by the Mineragraphic Laboratory of the Metallic Minerals Division.

Preparation of Samples:

Three polished sections were prepared from each of the samples with the exception of Flotation Concentrate No. 3. The latter was sent to the Chemical Laboratory for determination of sulphur, arsenic, antimony, copper, and zinc.

DESCRIPTION OF ORE SAMPLES:

Ore Sample No. 1.

The gangue material consists largely of grey translucent quartz and grey carbonate, some of which may be dolomitic. It is quite heavily mineralized with pyrite and arsenopyrite and with lesser quantities of tetrahedrite and stibnite. Native gold is abundant in the sections. Sphalerite is comparatively rare and chalcopyrite is practically absent.

Pyrite is the most abundant sulphide. It occurs as medium to small grains disseminated in the quartz, and in places is sufficiently abundant to form small granular masses. It commonly exhibits pyritohedral form. Some of the pyrite contains inclusions of gangue and in some areas is somewhat fractured. Some of the fractures, and also the interstices of the granular masses, are occupied by gangue, tetrahedrite, stibnite, and native gold, the last three only occasionally, however.

Arsenopyrite is common; it occurs as tiny crystals which locally appear as clouds of extremely finely divided grains in the gangue. Occasionally arsenopyrite crystals are associated with pyrite, and in these cases there is no evidence that the two minerals are different in age.

Tetrahedrite and stibnite are common. While only occasionally do they occur together, they have similar modes of occurrence. Large to small irregular areas and grains of the minerals are usually seen along stringers in the quartz and they are usually, but not

always, associated with carbonate. Where they occur together the boundaries are mutual and there is no evidence of difference in age, but where they occur with pyrite or arsenopyrite they form part of the vein material cutting the former, and they have enclosed grains of both of these minerals.

Occasional small irregular grains of sphalerite are present, usually in the carbonate. The mineral is a light-coloured variety, indicating that it is low in iron, and contains no chalcopyrite or pyrrhotite as do most sphalerites. It appears to be younger than pyrite and arsenopyrite and older than tetrahedrite and stibnite.

Native gold is abundant. It occurs as numerous irregular grains, as follows:

(1) Isolated from other metallic minerals in quartz, quite often along sinuous fissures and sometimes associated with carbonate;

(2) In quartz but in contact with pyrite, arsenopyrite, stibnite, tetrahedrite or sphalerite; and

(3) Within stibnite, in which case it is commonly very finely divided.

Table I gives the results of a microscopic grain analysis, in which 2,412 grains of native gold were measured:

(See next page)

TABLE I.

Microscopic Grain Analysis of Native Gold in Ore Sample No. 1.
(2,412 grains of gold measured)

Equivalent mesh (Tyler)	Alone in quartz, often with some carbonate, PER CENT	Associated with sulphides, PER CENT						Totals, PER CENT	Cumulative totals, PER CENT
		Against pyrite	Against arseno-pyrite	Associated with stibnite: Against	Associated with stibnite: Within	Against tetrahedrite	Against sphalerite		
+ 48	1.64	-	-	1.35	-	-	-	2.99	2.99
- 48 + 65	3.22	0.41	-	0.64	-	0.21	-	4.48	7.47
- 65 + 100	4.54	0.54	0.17	0.66	-	0.42	0.29	6.62	14.09
- 100 + 150	5.33	0.87	0.27	0.32	-	0.28	-	7.07	21.16
- 150 + 200	9.48	1.75	0.75	0.31	-	0.19	0.12	12.60	33.76
- 200 + 280	9.65	2.33	1.44	0.14	-	0.08	0.09	13.73	47.49
- 280 + 400	10.32	2.88	1.49	0.42	0.24	0.06	0.06	15.47	62.96
- 400 + 560	10.54	2.59	1.43	0.34	0.26	0.04	0.04	15.24	78.20
- 560 + 800	8.48	1.60	1.10	0.18	0.19	0.03	0.02	11.60	89.80
- 800 +1100	4.57	0.49	0.42	0.14	0.16	0.02	-	5.80	95.60
-1100 +1600	1.93	0.20	0.08	0.08	0.21	0.01	-	2.51	98.11
-1600 +2300	0.79	0.06	0.04	0.06	0.26	0.02	-	1.23	99.34
-2300	0.29	-	0.01	0.03	0.33	-	-	0.66	---
Totals	70.78	13.72	7.20	4.67 : 1.65 = 6.32		1.36	0.62	100.00	
				29.22					

Ore Sample No. 2.

The gangue of this sample is very similar to that of Ore Sample No. 1, with the exception that there is somewhat more dolomitic carbonate. The sample is not as abundantly mineralized as Ore Sample No. 1.

Arsenopyrite is the predominant sulphide. While the quantity is not large, and some areas are barren of sulphides, the mineral in places occurs abundantly as medium to small disseminated crystals. A small quantity of pyrite is present as scattered medium to small grains. Occasional tiny irregular grains of tetrahedrite occur in the quartz and very rare small particles of chalcopyrite were observed.

A number of grains of native gold are present in the sections, mostly in a section which also contains tetrahedrite, although these two constituents are not commonly in contact with one another. Native gold occurs as follows:

(1) In quartz, isolated from other metallic minerals and sometimes along sinuous fissures associated with carbonate.

(2) Against, but not within, arsenopyrite, pyrite, and tetrahedrite.

TABLE II.

Microscopic Grain Analysis of Native Gold in Ore Sample No. 2.
(132 grains of gold measured)

Equivalent mesh (Tyler)	Alone in quartz, PER CENT	Associated with sulphides, PER CENT: Against arseno-pyrite	Against pyrite	Against tetrahedrite	Totals, PER CENT
+ 280	6.57	-	-	-	6.57
- 280+ 400	13.83	1.73	1.73	-	17.29
- 400+ 560	14.52	2.25	-	-	16.77
- 560+ 800	31.12	2.59	-	1.21	34.92
- 800+1100	11.93	3.63	0.69	0.69	16.94
-1100+1600	3.46	0.69	-	-	4.15
-1600+2300	1.87	0.28	-	-	2.15
-2300	1.21	-	-	-	1.21
Totals	84.51	11.17	2.42	1.90	100.00

Ore Sample No. 3.

Light-grey dolomitic carbonate predominates over the quartz in this sample, the distribution of the carbonate lending to it a somewhat mottled grey appearance.

Sphalerite is the only abundant metallic mineral. It occurs as coarse to very fine grains scattered throughout the gangue. It is a light-coloured variety relatively low in iron content, and it does not contain inclusions of chalcopyrite and pyrrhotite so common in most sphalerites. It shows some tendency to occur with carbonate. Arsenopyrite is only locally abundant; it occurs as numerous tiny crystals in quartz, and in places is so fine that it appears as clouds of tiny particles. No coarse arsenopyrite is visible in this sample. A very small quantity of pyrite is present as medium to small grains disseminated in the quartz.

No native gold is visible in sections from this sample.

The relationships of the sphalerite are not well displayed. In places it has enclosed small grains of pyrite and arsenopyrite, suggesting its later deposition, and in one place it is interstitial in a group of pyrite grains. It appears to have been slightly attacked and replaced by carbonate.

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Ore Sample No. 4.

The gangue is similar to that of Ore Sample No. 3.

Sphalerite is the predominant metallic

mineral. It is present in the same relationships as in the previous sample, and is of the same light-coloured variety free from inclusions of chalcopyrite and pyrrhotite. These close resemblances strongly suggest that there is no difference in age between the sphalerites of Samples Nos. 3 and 4. Pyrite is sparingly disseminated in the quartz as medium to small grains, and occasional tiny crystals of arsenopyrite are present.

No gold is visible in sections from this sample.

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Relationships and Paragenesis of the Metallic Minerals:

The relationships of the metallic minerals have been noted in the above descriptions.

The significant features may be summarized as follows:

1. Pyrite and arsenopyrite show mutual relationships and are to be considered as contemporaneous.

2. All of the sphalerite, which is considered of the same age, is probably somewhat younger than the pyrite and arsenopyrite, and is older than some of the carbonate.

3. Tetrahedrite and stibnite appear to be practically contemporaneous but are distinctly later than pyrite, arsenopyrite, and probably sphalerite.

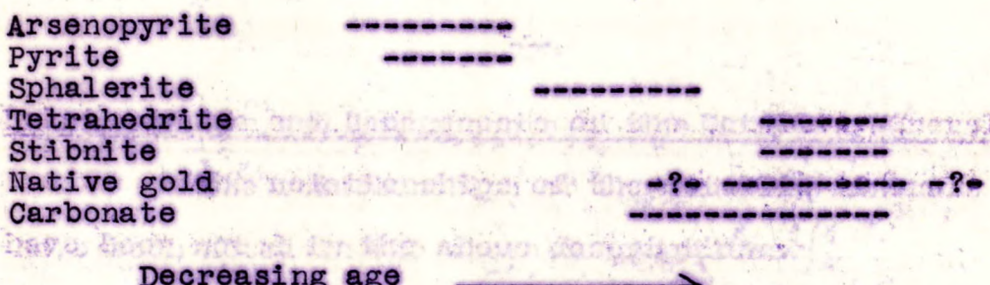
4. Visible native gold is distinctly later than pyrite and arsenopyrite, but whether its deposition started during the deposition of the sphalerite is not

known. Its relationships to tetrahedrite and stibnite indicate contemporaneity, and doubtless its deposition extended over a considerable period during which some of the sphalerite and carbonate, and most of the tetrahedrite and stibnite, were deposited.

The paragenesis is graphically presented in Table III.

Table III.

Paragenesis of the Minerals in all four Ore Samples.



DESCRIPTION OF MILL PRODUCTS:

Amalgamation Tailing No. 1.

This product is quite coarse. In addition to pyrite and arsenopyrite, it contains numerous large fragments of steel. No gold is visible.

Flotation Concentrate No. 2.

This product is quite finely divided. It consists largely of pyrite, arsenopyrite and gangue, with minor quantities of sphalerite and pyrrhotite. Traces of tetrahedrite, chalcopyrite and stibnite(?) are

present. All of these constituents show a high degree of freedom with the exception of an appreciable proportion of the arsenopyrite, many small crystals of which are still enclosed within gangue.

Eight grains of native gold are visible. They are entirely free and vary in size from slightly over 200 mesh down to 1600 mesh.

Chemical Analysis of Flotation Concentrate No. 3:

The chemical analysis carried out on this flotation concentrate by the Chemical Laboratory gave the following results:

Arsenic	-	12.10 per cent
Sulphur	-	25.92 "
Copper	-	0.22 per cent
Zinc	-	0,65 "
Antimony (Sb)	-	0.33 "

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