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GEOLGICAL FEATURES CONTROLLING

THE FUTURE OF THE

CLEVELAND MINE

VICINITY OF WARATAH

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GEOLOGICAL FEATURES CONTROLLING THE FUTURE OF THE CLEVELAND MINE, VICINITY OF WARATAH.

INTRODUCTION:

The Mount Bischoff Tin Mining Company has been carrying on prospecting operations at this mine for nearly two years and the present investigation was undertaken to determine the geological structure and features affecting the future of the mine and to examine the results of recent developmental work.

Owing to the extremely hard nature of the lode material and the attendant difficulties in obtaining truly representative samples no attempt was made to sample the various exposures as it was realized that the weekly sampling by the mine manager, W.H.Porte, from borings, strippings etc.would more closely approximate the true tin content.

SITUATION AND ACCESS:

The mine is situated near the summit of Crescent Hill, a long spur extending south west from the Magnet Range, approximately eight miles south west of Waratah and is reached by means of the Waratah-Corinna road. At the ten-mile a short branch road, on the south eastern side of the Whyte River connects with the mine a distance of about one mile.

The Mount Bischoff Tin Mining Company holds under lease 171 acres made up as follows:- 9382/M - 30 acres, 11486/M - 65 acres, 11489/M - 16 acres, 11492/M - 10 acres, 11530/M - 50 acres, together with Water Rights 3043/W and 3044/W.

PREVIOUS LITERATURE.

The only official report relating to this mine is contained in Geological Survey Bulletin No.34. The Mount Bischoff Tin Field by A.M.Reid, 1923.

Since that time, with the exception of the recent developmental work performed by the Bischoff Company, little work has been done so that the descriptions contained in the above report are in the main applicable to-day.

GENERAL GEOLOGY:

With the exception of the few dykes of basic intrusives associated with the Devonian granitic intrusion which trend in a general north-easterly direction, the whole of the area is occupied by rocks of the Dundas series of the Cambro-Ordovician system. They consist of grey,purple and red slates and cherts, intercalated with tuffs; in places,intense silicification has given rise to hard resistent quartzites.

The series has been subjected to minor faulting accompanied by drag folds and puckering. The main fracture zones have a general north easterly trend. The strike of the slates etc. varies between north 5° east to north 85° east while the dip varies from 45° to 80° and may be either to the north west or south east.

NATURE OF THE ORE-DEPOSITS:

These ore-bodies belong to the pyritic cassiterite type such as occur at North Dundas and Mt.Heemskirk.

The metallic sulphides are pyrrhotite, pyrite, arsenopyrite and chalcopyrite. The most abundant mineral is pyrrhotite and is frequently accompanied by a quantity of pyrite. The former is massive but the pyrite is often well crystallised.

Arsenopyrite is very irregularly distributed and was most noticeable in the battery lode.

Chalcopyrite is very widely disseminated but never abundant.

The tin ore present is cassiterite and the writer found no sign of stannite. The cassiterite is of a deep brownish colour and in a fine state of devision.

The most abundant gangue mineral is quartz, with some dolomite. The quartz assumes many forms and occurs most frequently as reticulating, acicular crystals.

Fluorite,most commonly pale green in colour, is a common gangue mineral in the fissure parts of the lode systems and in places represents at least 20 per cent of the lode material.

Green tourmaline is abundant in places and in the Khaki and Luck's upper workings forms a considerable amount of the gangue rock.

The internal structure of the lodes varies widely from point to point, according to the conditions of deposition. In Hall's Cut a massive structure consisting of quartz-pyrrhotite, forms the eastern limit, to the west of which is a zone which shows ill-defined banded structure. This is probably due to metasomatic replacement of successive xxri strips of country; the western limit of the crushed zone is an almost vertical wall clearly defined. This zone varies from 15 feet to 30 feet in width.

Although the lode fissures are strongly persistent up to lengths of over a thousand feet it is only where the fracturing has been intense and access for the mineralising solutions abundant that conditions have been favourable for the development of large fissure-replacement deposits, such developments occur at Hall's and Henry's Cuts and to a lesser degree at A.M.Reids No.12.

In places horizontal "feeders" give rise to apparently large areas of mineralisation which are not likely to persist to any great depth.

The distribution of tin ore in the massive lodes is very irregular and conditions governing the distribution could not be determined; no deduction could be made as to the influence of lode-structure on the mineral constitution of the lodes.

The genesis of the ore-bodies has been discussed at length in Bulletin No.34 and requires no further elaboration here.

As much depends upon the correct interpretation of assay results it has been thought advisable with the permission of the mine manager, W.H.Porte, to include a few comparative assays which he had made and the deductions drawn therefrom.

C02

	W.H.Porte.		Mines Office Laboratory, L'ton.
	Vanning	Wet process	Wet process.
1.	0.8	1.25	1.34
2.	0.15		0.31
3.	0.5		1.16
4.	0.7		1.14
5.	0.2		0.30
6.	0.9	1.3	1.39
8.	1.5	2.4	2.62
9.	0.6	1.2	1.04
10.	0.7		0.86
Average of 1,6,8 and 9)	0.95.	1.55	1.60

This shews approximately 50% increase in the chemical assay on a vanning one. It is estimated that a good mill will recover about 60% of a chemical assay, therefore, an estimated recovery of 90% of a careful vanning assay can be anticipated.

The assay results given in the text are from vanning assays.

MINE WORKINGS:

"Battery Lode"

The lowest adit is situated approximately 120 feet south of the old battery site. It was driven in a north westerly direction 110 feet where the "smithy" lode, a parallel lode approximately 50 feet west of the "battery" lode, was intersected; the lode, about twelve feet wide, was driven on for nearly 30 feet in a northerly direction. The lode material consists of dense pyrrhotite with a little chalcopyrite and quartz. Selective replacement is much in evidence where the rocks differ in physical character and chemical composition and in places the deposition of sulphides has been complete while adjacent sediments are wholly unaffected.

From surveys made, it was apparent, that the lode intersected in this adit was not the "battery" lode, so with a view to testing the "battery" lode below the present workings, the Mount Bischoff Company decided to cross-cut in an easterly direction; after driving 65 feet the "battery" lode was cut and where cut in the cross-cut the tin values were very low but improved as driving north on the lode proceeded, up to 30 feet. From this point they steadily decreased over the last 40 feet of driving.

The lode material is substantially the same as in the "smithy" lode except that arsenopyrite and fluorite (dominantly pale-green in colour) are more abundantly developed. The fissure from which replacement has taken place dips south west at 30°; the channel shews banded structure with metallic sulphides, predominately pyrrhotite with lesser amounts of chalcopyrite , pyrite and arsenopyrite with gangue mainly fluorite, pale green to purple in colour and in places abundant development of kaolin. The lode reaches a maximum width of 15 feet and is bounded on the hanging wall side by cherts and highly silified slates striking north 5° east and almost vertical. The footwall rock consists of grey slates. The lode appears to flatten as it proceeds northwards and there is a marked decrease in tin-content as the following assays results of sampling indicate:-

Section.	No.of samples.	Average tin content.
0 - 10'	14	0.73 per cent.
10'- 20'	8	0.94 " "
20'- 30'	9	0.64 " "
30'- 40'	8	0.47 " "
40'- 50'	5	0.50 " "
50'- 60'		0.26 " "
60'- 70'		0.30 " "

If the battery lode continued on line to the south without interruption, the adit should have cut it at not more than 50 feet from the portal but no evidence of the channel could be detected, therefore,it is apparent that the lode does not continue without serious diminution or that it has been faulted to the east, the former seems the more probable as no evidence of an east-west fault was observed in the cross-cut.

LUCK'S WORKINGS:

These are situated approximately 600 feet north, north - west from the adit on the battery lode.

As reported in Bulletin 34, portion of Luck's No.1 workings had collapsed and was inaccessible. Therefore, to test the reported richness of a winze in this part of the lode the Bischoff Company drove an adit a little west of north for 190 feet to a point approximately 63' below that level, but it was found necessary to pick up the fallen ground in order to locate the exact position of the winze which had been sunk to a depth of 45 feet. After the survey had been made the adit was driven in a south westerly direction for approximately 20 feet and then a connection wa made with the winze by an eighteen foot rise. In the winze levels had been opened out at 40 feet exposing the ore body over a width of 24 feet; here the fissure is well defined and filled with fluorite and a little arsenopyrite etc.

Kaolinization is well developed in the southern crosscut and does not appear to continue to any great extent below this level. The hard, quartz-pyrrhotite mass occurs on the south-western side of the fissure in the drive 18 feet below and the average tin content for 35 feet was 0.36 per cent.

THE KHAKI WORKINGS.

These are situated approximately 200 feet north of Luck's workings and with the exception of some work by Cousins and party little or nothing has been done since Messrs.Luck and Thompson ceased work.

The two ore-bodies consist of three main fissures. The southern ore-body has developed along a fissure about 50 feet from the mouth of the adit; it strikes north 85° west and dips south-west at 60°. The lode has been stoped, practically to the surface over a length of about 130 feet.

Three samples indicate the value of the last 21 feet in the east end of the drive (No.3 S.E.)

Position.	Sample Section	Value.
75' from Cross-cut	20 inches	0.75 per cent.
85' " "	72 "	0.61 " "
end of level	48 "	0.70 " "

The other ore-body, 75 feet to the north consists of two main fissures with partial replacement of the intervening tuffs and cherts.

The ore consists almost wholly of gossanous and extremely cellular quartz with which blocks of unaltered slates are associated. The structure is complex with marked variation in the strike and dip of the various blocks which vary also in lithological character. In No.2 south west drive green tourmaline is abundant.

The tin distribution is very irregular and although the general average is low, several isolated occurrences gave relatively high assays as the following samples shew:-

Location.	Sample section	Tin content.
No.2. N.E.Drive		
12 feet from Cross-cut.	36 inches	1.1 per cent.
35 " " " "	30 "	0.6 " "
45 " " " "	48 "	0.13 " "
51 " " " "	60 "	0.65 " "
No. 3. S.E.Drive.		
On south-east side of drive	30 "	1.8 " "
On east side of Cross-cut	20 "	1.1 " "
No.1. S.W.Drive.		
3 feet from cross-cut	5 feet	0.2 " "
15 " " "	6 "	0.25 " "
42 " " "	6 "	0.6 " "
52 " " "	5 "	0.7 " "
63 " " "	4 "	0.3 " "
No.2. S.W.Drive.		
5 feet from Cross-cut	6 "	0.2 " "
17 " " "	8 "	0.3 " "
30 " " "	10 "	0.15 " "
52 " " "	3 "	0.15 " "
Centre of north-west drive 5 foot section -	-	0.2 " "

To test the ore-bodies worked in the upper Khaki level an adit was driven nearly 200 feet on a bearing of south 70° east and the only lode intersected was that worked in the No.2 N.E.drive. It was cut about 18 feet below the other workings. The lode was driven on for about 30 feet to the north-east and 35 feet to the south west; a rise from the end of the south-west drive connects with the workings above. the lode consists of gossanous and cellular quartz and is exposed over a width of 14 feet. There is a diminution in tin content compared with the level above as the following indicate:-

Location.	Sample section	Tin content.
No.2 Khaki level.		
2 feet east of cross-cut	3 feet	0.4 per cent
14 " " " "	4 "	0.7 " "
16 " " " "	3 "	0.3 " "
4 " west " "	3 "	0.3 " "
24 " " " "	3 "	0.3 " "

HALL'S CUT:

Approximately 800 feet north of and over 300 feet above the adit on the smithy and battery lodes is the main open-cut; it is very irregular and somewhat crescentic in shape and altogether is over 400 feet long. The width varies from 15 to 50 feet and it is about 60 feet deep. The southern portion is 225 feet long and courses north 30° east; the northern end is approximately 180 feet on a bearing of north 60° east.

The large irregular mass of quartz-pyrrhotite-chalcopyrite extends along the footwall and forms the south eastern boundary of the cut, while to the west silicified and mineralised grey slates and cherts are overlain by a soft grey slate hanging - wall dipping to the north west at angles of 60 - 80 . A band of unaltered slates occupies the centre of the ore-body. The main fissures and zones of mineralisation strike north 5°east.

The Mount Bischoff Tin Mining Company drove an adit a little over a hundred feet in a north westerly direction to test at a depth the northern end; the lode was driven on for a distance of about 75 feet in a south westerly direction.

The tin content shewed slight increase as driving proceeded.

Sample Section.	Tin Content.
0 - 10'	0.5 per cent
10'- 20'	0.57 " "
20'- 30'	0.47 " "
30'-40'	0.47 " "
40'- 50'	0.55 " "
50'- 60'	1.10 " "
60'- 70'	0.6 " "
70'- 75'	0.77 " "
	Average = .63 " "

Width of lode - 17 feet.

In the adit the slates strike south 55° west and dip north west at 66°. The foot-wall of the lode is almost vertical and very sharply defined and consists of silicified slates almost wholly replaced to quartzites.

HENRY'S CUT:

This cut is 250 feet north approximately from Hall's cut and exposes an ore-body developed on a line about 175 feet northwest of the continuation of Hall's cut. The cutting is 150 feet long 50 feet wide and 60 feet deep. Two main fissures converge on the northern end leaving a large mass of unreplaced chert and slate between them. Small masses of quartz-pyrrhotite-chalcopyrite are developed along the eastern side.

The mount Bischoff Company drove an adit below this cut 175 feet in a north westerly direction to test the downward extension of the ore-bodies. At 140 feet from the mouth No.1 seam with a width of 26 inches was cut. Three samples gave an assay of one per cent tin. No.2 seam was cut at 147 feet and three samples gave an average tin content of 0.85 per cent over a width of 25 inches. This was driven on in a south-westerly direction and for 13 feet(six samples) the tin content averaged 0.96 per cent over an average width of two feet. As driving proceeded it was found that this was only an isolated development on the fissure which continued with a considerable reduction both in size and tin content.

The average tin content was 0.23 per cent.