PRELIMINARY REPORT ON THE SWANSEA AREA

INTRODUCTION

The Swansea ore-body was discovered by A. Montgomery about 25 years ago when engaged on a geological investigation of the district. Since that time mining operations on these lodes have been in the hands of several parties, but little success attended their efforts until the advent of the present owners (R.B. Hill, J. Dunn and J.J. Hill) four years ago. The heavy cost of transport, the small silver content of the ore, and the low market rates for silver, lead and zinc all contributed to the failure of the earlier operators. The Swansea Syndicate had the advantage of Government assistance in partly defraying the cost of a tramway and the construction of a dam and water-race to provide power to the mine. Nevertheless, full credit is due to them for their perseverance, under adverse conditions, in bringing the enterprise to a successful issue.

AREA, SITUATION, ETC.

The property held by the Syndicate consists of lease 7351-M of 10 acres and lease 8218 of 30 acres in addition to a dam site and water-race and tramway rights, all of which are charted in the name of J. Dunn. It is situated two miles westward of Mt. Zeehan and four miles south-west of the township of that name.

ACCESS AND TRANSPORTATION

From Zeehan a two-feet gauge, Government owned, steel rail tramway passes within 1½ mile of the mine on its way to Comstock. A branch tramway connects the Colonel North mine at a point three miles from Zeehan bringing the Swansea mine within easy access. Since the Syndicate took charge the mine has been connected to the main lines of transport by means of a wooden-rail, horse tram. By this means five tons of ore is conveyed by one horse to the Government tramway per day of eight hours.

GEOLOGY

General Description

The larger part of the area is occupied by Cambro-Ordovician slates, sandstones, grits and quartzites with intercalated beds of volcanic ash. Bordering the area on the east side is Mt. Zeehan the greater part of which is composed of conglomerates and sandstones of Silurian age. Into these old sediments narrow dykes of gabbro, pyroxenite and felspar porphyry have been intruded. The dykes are really apophyses of the igneous mass of basic and acidic rocks forming Mts. Agnew and Heemskirk on the west side of the area. Their outlines are difficult to follow owing to their deep covering of peaty soil and button-rush and allied plants. The creek beds afford the best opportunity for their examination except where artificial openings have been made.

The zinc-lead ore product of the Swansea mine is drawn from two lodes which occur on the hanging and foot-wall sides of a narrow dyke of soft, white, felspar-porphyry. The identification of this rock is given with hesitation as it is completely decomposed, but it proves on analysis to

consist largely of kaolin with an appreciable amount of potash and a little soda. Apparently it is in the form of a dyke as it crosses the strike of the sedimentary rocks, and probably it is connected with the felspar porphyry dyke located by the writer 30 chains to the north-west.

Structural Features of the Ore-Deposits

Two series of fracturing are exhibited here: fault fissures or slides and lode fissures. The former are the older and they have caused the lateral displacement of the rock formations in which the lodes occur. So far as can be seen the lode fissures do not bisect the fault but bend at the point of junction and coincide with it. Deposition of material from solution in the fault channel is confined to older quartz fillings in the interstices of the "crush" rock. However, metallic ores are found 10 to 20 feet round the bend along the course of the fault and also from 3 to 10 feet on the true course of the lode beyond the fault line.

The occurrence of ore at the intersection of the fault and lode fissures is marked by a far greater bulk of zinc-lead ore and a preponderance of the lead component. Whether the ore-shoot will lengthen or shorten from this point with depth cannot be predicted with certainty. Encouragement is given by the fact that the shortening of the stope length on the Zeehan field is not general. The presence of the largest and richest deposits at and near the point of intersection of the two sets of fissures is due to the better facilities thus provided for the circulation of ore-bearing solutions from their source and the larger openings for their reception. The conditions will be found to vary with depth, consequently deposits of irregular magnitude may be anticipated.

Probably both physical and chemical influences govern the distribution of the ore-deposits. The fractures along the lines of contact between such dissimilar rocks as slate and felspar porphyry are clean breaks whereas lodes contained wholly in black graphitic slate nearby are narrow and very irregular. Again there is decided evidence of replacement of the felspar-porphyry by zinc and lead sulphide and silica, although it should be noted that part of the quartz filling of the channels is older than the sulphidic minerals.

THE ZINC-LEAD ORE-BODIES

In the main workings two lodes have been worked for their content of galena and sphalerite. Besides these minerals tetrahedrite or fahl ore occurs scattered through the ore in blebs, streaks and irregular bunches. No definite order of deposition is apparent but the minerals are not in general intimately associated, nor is there any tendency to regularity in their occurrence. The association is such that one mineral can generally be separated from another by a blow of the hammer and advantage is taken of this in effecting the separation of the valuable minerals by hand-sorting. In some parts lead ore predominates and zinc is subordinate; in others the reverse is the rule. The galena occurs from extremely fine grains to very coarse grains and crystals. The sphalerite or zinc blende is light resinous yellow in colour, coarse in texture, and possesses

a brilliant lustre. It is a very high grade ore of zinc but contains an appreciable proportion of cadmium. This is rather unusual as the darker-coloured sphalerite, so abundant in Tasmania, contains very little cadmium in comparison. The galena is usually streaky in coarse grain, but in the fine state it is made up of equi-dimensional crystals and in this condition is always associated intimately with tetrahedrite. It is noteworthy that the pyrite of these lodes is disseminated through the dyke rock and invariably is found crystallised in pentagonal dodecahedra. The porphyry is seamed with quartz veins.

In the upper level ore-shoots occur on the hanging and footwall sides of the felspar-porphyry dyke. The hangingwall deposit is called "Murphy" lode, and the footwall one "Main" lode. These lodes strike in a north-westerly direction and dip at an angle of 45 degrees to the north-east. They and the encased porphyry are interrupted by a fault of considerable magnitude which has caused a lateral displacement of fifty five feet to the west and of unknown extent to the north in which direction it dips rapidly giving to the ore-body a northerly pitch.

THE NICKEL ORE-BODIES

This report would be incomplete without reference to the discovery of nickel-bearing pyroxenite in the south-eastern part of the area between the Swansea and Silver Duke Mines. The pyroxenite occurs in the form of a narrow dyke which courses in a north-westerly direction to join the parent mass of basic rock in the vicinity of Heemskirk. The outline of the dyke has not been accurately traced and the examination of the rock and its associated ores has received little attention as yet; but it certainly warrants more careful investigation. In the body of the pyroxenite the nickel-bearing mineral genthite makes its appearance, but it has not been found yet in concentrations of commercial importance.

In places along the footwall side of the dyke there are indications of bodies of sulphide of nickel. At these points the basic rock has been completely converted into dolomite. A notable mineral is millerite (sulphide of nickel) which occurs in radiating, delicate, hair like tufts implanted on dolomite and associated with pyrite. A little pentlandite (sulphide of nickel and iron) occurs, but oxidation of this compound has been rapid, and very little remains to be seen.

DEVELOPMENT

Development openings on the main ore-body consist of a vertical shaft for drainage and haulage purposes, and underlay shaft on the footwall branch of the lode, and two adits into the Main and Murphy lodes. The main shaft sunk on the hangingwall side of the dyke passed through a cross lode at 45 feet and penetrated the main ore-body at 80 feet. The cross lode mentioned is twelve inches wide but of unknown extent. A cross-cut was commenced a few feet south of the shaft to expose this body at the 80-feet level, and such a large volume of water was set free that work in this end was discontinued. Later the north drive at this level

was continued to the point of intersection of this and Main lode and the drainage now comes from that quarter indicating an unexplored channel of considerable dimensions and one likely to contain sulphide ores of value. The north drive on the main ore-body for 20 feet showed a cellular and vughy mass of white opaque quartz, but later developments in this end exposed another shoot of zinc-lead sulphide ore which gives promise of continuance in that direction. Driving south on the ore body at this level a galena -sphalerite ore-shoot continued up to the fault. Beyond that point no ore of value was found, nor was there any trace of the lode. A rise near the fault connecting this and the 50-feet level exposed a massive body of zinc-lead sulphide ore from 6 to 12 feet wide. This big mass gradually thinned to two feet in width at a point forty feet northward conforming to the average size of the ore-body in the main channel.

Development openings at the 50-feet level are much more extensive. Here Main and Murphy lodes are separated by forty feet of porphyry rock and continue northward from the fault a distance of ninety feet, gradually petering out in the soft kaoling of the dyke rock. A considerable amount of driving has been performed along the course of the fault at the 50-feet level but without important results, a little ore being obtained at the beginning and bunches only here and there farther on. The ore-body has not been traced at surface, but indications have been obtained of its continuance northward in a trench four hundred feet distant. When the water rose in the main shaft a heavy flow of water drained through a hole in this trench.

Another occurrence of similar zinc-lead sulphide ore outcrops 250 feet north-west from Main shaft. At surface the ore contains more sphalerite (zinc blende) than galena and chalcopyrite is prominent. The gangue here again is quartz-white, opaque and cellular. On this body a shaft (now full of water) was sunk 40 feet without revealing any change in the size and content of the ore-body. Where exposed it is 10 to 20 inches wide and is of low grade.

It is difficult to ascertain what relation exists between this and the ore-body in the main workings. The country rock is similar and the conditions do not show any variation, yet this shoot is not comparable in importance with the other nor is it on the same course. This lode cannot be traced at surface nor can the dyke rock, unless the occurrence to the westward is in faulted position. Unfortunately there were insufficient exposures to enable the investigator to decipher the details of the structural geology.

The Tasmania or McLean lode passes through the south-west corner of the property and several parallel bodies have been worked with fair success in the immediate neighbourhood.

FUTURE EXPLORATION

Before sinking the main shaft the most important work to be undertaken is the exploration of the ore-body at the 80-feet level. Attention should be confined to the driving of the north end along the footwall side of the dyke. Although quartz may constitute the bulk of the ore-body in places rich shoots of zinc-lead sulphides may be safely anticipated to succeed the barren sections. The

future of the mine depends largely on the result of these operations. The cross lode should prove worthy of investigation.

Southward beyond the fault the conditions are not at all encouraging. The most important ore-bodies will be found closely associated with the dyke rock.

EQUIPMENT

Drainage of underground workings is effected by means of a six-inch draw-lift pump operated by a 15-feet diameter water-wheel. The water supply is obtained from a dam in the valley of a branch of McLean Creek, and is conveyed to the mine - 100 chains distant - in a water-race 3 feet wide and 2 feet deep. The power obtained is ample for present requirements.

The power for haulage is obtained from an oil engine connected by belt to a geared winding drum. The rate of haulage is slow, but this appliance answers the purpose satisfactorily.

Concentration of screenings is effected by means of a set of plunger jigs connected to a water-wheel, the power for which is obtained from the discharge water used in driving the pumping plant.

The usual mining accessories complete the equipment.

PRODUCTION AND VALUE

The production of the early days is estimated at 300 tons of galena ore of high grade, and that of Hill and Party is 700 tons, or 1000 tons altogether. Ore of the quality exported at present is worth ten guineas per ton at Zeehan. Two men mine twenty tons of galena per week and about the same quantity of zinc blende, and keep four men employed at surface at other occupations.

The value of the ore is shown in the following table of recent account sales:

Weight	Content		Gross Value	Net Value
Tons	Silver oz.	Lead %	per ton £ s d	per ton £ s d
30	18.1	65.65	17 7 6	10 17 6
28	19.2	64.1	17 0 1	10 10 1
63	19.8	67.9	18 2 5	9 14 7
26	19.7	71.1	18 18 0	10 10 0

The ore is sold to Messrs. O.T. Lempriere & Co. of Melbourne.

The present rate of output can be maintained without difficulty with this small staff until the end of the year. In mining the narrower portion of the lode more men will obviously be required in the underground department to keep to this rate of production.

It is estimated that there are 1000 tons of high grade zinc blende stacked at surface, and there are, in addition, several hundred tons in the stopes available for excavation. These heaps of ore contain about 48 per cent zinc, 8 per cent lead and 2 per cent cadmium. The value of this class of ore at Zeehan railway station is only £2.12.6 per ton at the present time.

CONCLUDING REMARKS

From Zeehan as a centre prospecting expeditions have been conducted within the compass of a circle of long radius in all directions with one exception - the south-western part beyond the Swansea area. The arc of four-miles radius touching the Duke, Swansea, Tasmania, Stonehenge T.L.E. and Comstock mines marks the outer limit of the prospected area in that direction. Why the country beyond this line has been so long neglected it is difficult to comprehend. Probably one reason is that this is the limit of easy walking distance for miners operating from Zeehan, and again because there are no lines of communication into that area. But the difficulties of access have been greater in some more favoured localities, yet this has not prevented their thorough exploration. The geological conditions suggest the presence of zinc-lead, nickel and iron ores associated with the igneous rock formations known to exist in that area. These igneous rocks are of two kinds: basic represented by gabbro and serpentine dykes; and acid represented by granite and granite porphyries. Associated with these dykes the richest ore-bodies will be found.

As to the particular subject of this report it is considered that there are no reasons to doubt the persistence of zinc-lead sulphide ore in paying quantity to a depth of 200 feet at least at the Swansea mine. In places the ore-body consists almost wholly of white opaque quartz from which the associated sulphide ore has been leached by percolating solutions, and in places quartz occurs as a secondary replacement of the ore; but no secondary sulphides were observed and the primary ore persists at the lowest level. If the lode is proved to continue strongly along its course no apprehension need be felt regarding its continuance in depth. The operators should not feel discouraged if the rich ore appears to peter out for ore-bodies of this kind are notoriously erratic and it probably will be found to grow in size as suddenly as it gave out.

A.M. Reid

GOVERNMENT GEOLOGIST.

LAUNCESTON.

16th November, 1922