PRELIMINARY REPORT ON PINE HILL AREA

INTRODUCTION

This area has been the subject of brief mention in the daily press, and of articles in the mining journals at many times. The earliest record is contained in "The Zeehan and Dundas Herald" of 13th November, 1893. In that issue of the newspaper, reference is made to the discovery of the famous Gormanston Nugget by Thos. Strong and R. Bennett, prospectors in the employ of the Gormanston Tin Mining Company. The following dimensions were given: length 3 feet 4 inches to 5 feet; width 3 feet 6 inches; thickness 1 foot 4 inches; and the weight was computed at 19 cwt. Accompanying this nugget were many others of similar character but of smaller dimensions, from 50 to 250 lbs. in weight, containing tin in the proportion of 60 to 65 per cent. These boulders of tin ore were found in the bed of Gormanston Creek reposing on iron-cemented detritus and covered by talus materials from the quartz-felspar-porphyry cliffs of Pine Hill.

The largest nugget was purchased by the Government for £50, and was shown at the Hobart Exhibition in the year 1894. It was then placed in the Museum; but lately it has been added to the collection of minerals for the British Empire Exhibition.

Since the time of the discovery, many attempts have been made to locate the source of the nuggets, and to uncover the lode that shed them. Interest in the occurrence has been revived of late following the discovery of many similar boulders near the base of the talus 50 feet west of Gormanston Creek. With the object of assisting the prospectors in their search, the writer was detailed to investigate the area and report the result of his researches to the Mines Department.

GEOGRAPHY

Situation and Access

Pine Hill area is the southern quarter of Renison Bell Tinfield and is three miles distant from the settlement of that name. Zeehan, which has a population of 3,000 is the supply centre and is only 11 miles distant by rail. From Zeehan the area is easily accessible by the Government owned North East Dundas tramway of 2-feet gauge by way of Confidence Saddle or by the Emu Bay Railway Company's railway through Renison Bell. The railway system connects with the port of Strahan on the west coast, and with Burnie on the north.

Physiography

This is part of a high mountainous area traversed in a northerly course by numerous tributaries of the Pieman River. Precipitation is heavy and fairly general throughout the year, and most of the streams, even the minor ones are perennial. After uniting to form the Ring River to the east and Argent River to the west, both stream systems flow northerly to the main channel beyond Renison Bell.

Commonwealth Hill on the western side of the area rises 2,100 feet above sea-level, and Pine Hill is nearly 1900 feet in altitude. The hillsides are very steep, even precipitous, and the lower slopes are covered deeply with talus from the porphyry backbone of the hill. Investigation has shown that there have been distinct slides of talus material from the base of the porphyry cliffs on the north side of Pine Hill. These materials have completely covered the rock formations and the contained lodes, thereby impeding exploration.

GEOLOGY

General Features

The rock formations include several thousand feet of Cambro-Ordovician slates, sandstones, and tuffs, belonging to the Dundas series of sediments. They have been intruded by dykes of Devonian gabbro, gabbro-amphibolite and pyroxenite, and later by narrower dykes and sills of quartz-felspar porphyry. The basic and acidic intrusive represent two distinct products of differentiation from one stock magma. The gabbro-pyroxenite intrusion was unaccompanied by mineralising solutions and had little effect on the invaded sedimentaries; but the later intrusion of porphyry, besides introducing the ores of tin and other metals, greatly affected the sediments and near the line of contact, completely transformed the basic dyke rock. The comparatively large basic dyke trends in a south-westerly direction, whereas the acidic dyke, which intersects it, strikes in a south-easterly direction. These intrusions caused two sets of fractures, each parallel to the course of the respective dyke and consequently nearly at right angles to one another. At Pine Hill the regular course of the porphyry dyke is disturbed and the width there is much greater than elsewhere. Connected with the main body are several sills which have a general northeasterly dip at angles of 40 to 50 degrees, and on the northern side they have a crescent-shaped outline. Below this embayment the large nuggets of tin ore were found.

Nature of the Ore and its Occurrence

Gormanston Nugget and all the smaller nuggets of tin ore found with it in the bed of the creek, and also the rich boulders recovered by Coleman in sluicing the porphyry talus immediately to the west thereof, are quite unlike the specimens found in direct association with the porphyry dykes. The former are all of extremely fine grainsize, intimately associated with equally dense greenish-black tourmaline and hard bluish quartz. In occasional cavities the cassiterite is coarser and well crystallised, and it is not uncommon to find blocks consisting of in a felted mass of extremely fine acicular crystals of tourmaline. As a rule the tin ore occurs in blebs and patches with the quartz and tourmaline but disseminated ore is always in evidence. The boulders are angular and sharp-edged, showing little sign of attrition. They exhibit all the characteristics of replacement phenomena, simulating the habit and texture of the replaced rock. Careful examination shows that the original rock was of basic character conforming to gabbro-amphibolite and in places to serpentine. The talus materials in which these boulders of tin ore occur overlie decomposed basic rock, but strangely, no dolomite is reported. This is extraordinary, as in the process of transformation the dolomite phase is usual. Farther removed from the porphyry intrusive, actinolite and fibrous magnetite with a little axinite, have been developed at the expense of the original basic rock.

The cassiterite (tin ore) directly associated with the porphyry dykes and sills, is of quite different character. It is coarse-grained as a rule, sometimes in well developed drusy crystals, and is commonly found attached to altered porphyry. Perfect pseudormophs of cassiterite after felspar are so common as not to excite attention. These replacements usually occur near fissures and joints in the porphyry, or near the line of contact. Where cassiterite is abundant, the bluish-green zeuxite variety of tourmaline is highly developed and replaces the original felspar component of the rock. Topazisation of the felspar and even of the quartz is prominent at certain points. It may be taken as a safe criterion that the occurrence of zeuxite is indicative of the near presence of cassiterite.

THE ORE BODIES

Tin bearing ore bodies occur on all sides of the main mass of porphyry at Pine Hill and some of them actually intersect both dykes and sills. These ore bodies have been explored by means of trenches and adits, but none of the exposed deposits has proved of phenomenal richness at any point. In this, as in every other mine in the district, the work of exploration has not been designed to the best advantage, consequently the ore bodies may still be regarded as unprospected, and their value unknown. On the accompanying plan the several ore bodies are marked and the workings are shown, but that from which the nuggets were derived is not indicated because the precise position is unknown. It is a north-easterly-bearing lode passing close to the dam near the southeast corner of Heywood's block, and may be connected with the ore body exposed in No. 10 tunnel. On this line a rich tin-bearing vein passes through the porphyry sill.

It will be noted that there are two groups of lodes and veins, one coursing east of north, the other west of north. One group represents lode fissure, the other fault fissures. Where a fault fissure intersects a lode fissure, material rich in tin ore occurs, and the other part of the lode is comparatively poor. It is not uncommon to find several fault fissures traversing one lode fissure in which event recurring shoots of ore may be looked for. Some of the ore bodies have not been traced far, but others have been proved to extend half a mile. The lode on Carlson and Riley's section, for instance, extends beyond No. 11 tunnel, south east of Albury's block, more than half a mile.

In a cutting and shaft near the western boundary of Albury's block, a very rich body of tin ore occurs. It is however, comparatively small and not of much importance. Nearby, in No. 9 tunnel, rich stone was obtained from a shoot nearly 100 feet long, but as the workings were continued north easterly in quartz-felspar porphyry instead of along the line of contact the tin ore petered out. It should be noted that the fresh felspar in the porphyry at this point clearly shows that mineralisation was not important. If it had been, the felspar would have been transformed into tourmaline, or topaz, or sericite.

Fairly rich ore was obtained from veins intersected in Nos. 1 and 3 tunnels, but developments generally were discouraging.

The most important of the known ore bodies are contained in porphyry. One of these trends in a north westerly direction from the summit of Pine Hill, and is clearly indicated by a broad, white line of secondary quartz associated with zeuxite. These veins have shed most of the alluvial ore found in Penzance Creek. The so-called actinolite-magnetite lodes are not likely to contain important bodies of ore.

As the actual purpose of the visit was to locate the source of the Gormanston Creek boulders of tin ore, attention was directed particularly to that end; but, in so far as time allowed, a survey of the whole area was attempted. For certain reasons, which will be given later, it is considered that the north side of the hill presents the most encouraging features, and on that side the nuggets are found. These nuggets are confined to a narrow strip embracing Gormanston Creek and Coleman's open-cut, a width of 300 feet. Many years ago in sluicing the "wash" lower down the stream many large nuggets were recovered, but these evidently were carried there by flood waters and were derived from the same ore body as the Gormanston boulders. The size, richness, and nature of these boulders, their association with large blocks of sulphidic material consisting of marcasite, chalcopyrite, and arsenopyrite, and their unworn appearance, suggest that the parent ore body is dominantly sulphidic, that it occurs in the immediate vicinity south of Coleman's workings, and that sections of it are unusually rich in tin ore. It appears at first glance that the winning of this prize should prove such a strong incentive to exploration that a sustained effort would be made, but when it is realised that the water supply at this elevation is very small and that the covering of detritus and talus materials is very deep, the reasons for the failure of the operators is at once apparent. However, the prospectors are mindful of the importance of their work, and are prosecuting the search by the gradual removal of the covering material. They are working in the right direction albeit very slowly.

The conclusions arrived at in this report are based on the evidence which follows:

The hummocky nature of the topography clearly indicates a number of landslides. Proof of this is found in examining Albury's and Coleman's workings in the talus material where slickensides are sharply marked and the broken rock is distributed in tumultuous confusion. The section in Coleman's workings, which follows a narrow ridge may be employed in explanation of these occurrences. The upper part of the section is represented as an inverted segment showing 4 feet of broken porphyry resting on 12 feet of dun-coloured material derived from decomposed basic rock. The slickensides on the bottom and sides of this material and the presence of much oxide of iron dividing it from the underlying porphyry and lode detritus, show that the ridge occupies the course of an old gutter. A little tin ore occurs in the upper bed of porphyry boulders, very little in the clayey material, but very considerable in the lowest bed on and in which are also found the largest nuggets. It appears that the gradual disintegration and removal of the lode materials and the soft containing rock resulted in the undermining of the sharp ridge of porphyry on Pine Hill, and its partial collapse. The landslip that followed passed over the lode carrying with it large blocks of tin ore and boulders of sulphidic minerals. The exposed lode was then open to renewed attacks by oxidising agents - the marcasite component suffering complete transformation, the others in less degree - and the resultant oxide of iron carried away in solution and redeposited forming the cementing

medium of the agglomerated material. Some of the large nuggets were found resting directly upon the cemented rock. These were shed subsequent to the first landslide, and probably were carried down by the succeeding one. The direction is marked by the slickensides which course 10 degrees west of north, continued southward the course leads over a depression in the landslip known as "the crater" towards three lodes exposed on the track near No. 2 tunnel. These lodes apparently junction at "the crater" and may prove to be off-shoots from the main body which on the evidence at hand should pass through the "crater" in a north-easterly direction.

In Gormanston Creek up to the northern boundary of Albury's section and towards the south-western corner of Heywood's section, the bedrock exposed by the sluicing of the detritus overburden is a completely decomposed basic rock. At the north-eastern corner of Albury's, the rock is hard actinolite which continues unbroken 10 chains to the southward; at Nos. 1 and 2 tunnels the rock is apparently fairly hard altered slate and tuff, which in places appears very similar to altered actinolite and may be so; at none of these places has any rich ore been found, nor has the decomposed gabbro been seen so far south. (It is at the gabbro junction or near it that the rich body is expected.)

About 150 feet south of the southwest corner of Heywood's section the bedrock is exposed. It consists of sericite, saussurite, a little talc, and much limonite, and appears to be close to the lode line which here is not likely to prove of any considerable dimensions. Farther to the north east on the southern boundary of Heywood's section similar materials are exposed but saussurite predominates. In these workings large blocks of lode material consisting almost wholly of marcasite are frequently uncovered, but no nuggets of the dense tin ore are found. Slickensides trending almost due north, and evidently of the same age as that recording the landslip at Coleman's, are marked on the clay-like bed of the porphyry talus. At Coleman's the clayey material represented a "false bottom" to the porphyry boulders, but here it appears to represent the bedrock of gabbro completely decomposed. If such be the case, the location of the ore body should not prove difficult.

On the foregoing evidence it is considered that the ore body occurs in the crater-like depression marked by the dam beyond the southern end of Heywood's section, and that it courses in a southwesterly direction conforming to the strike of the basic dyke.

COMPARISON WITH THE MOUNT BISCHOFF DEPOSITS

A brief inspection is sufficient to disclose the remarkable similarity between the Mount Bischoff and Pine Hill occurrences. In the first place the formations represented there are represented here and secondary minerals associated with the ore deposits are identical, thus clearly indicating like conditions of development. Moreover, the outlines of these formations show an extraordinary resemblance, especially is this so in comparing Brown Face deposit of Mount Bischoff with the crater-like area on the northern end of Pine Hill, where the dykes and subsidiary sills almost encircle the ore body. The general dip of the dykes in both cases is northeasterly, but the sills dip towards a common centre.

The complexity of the intrusion produced by the sills caused the complete dislocation of the invaded slates and basic igneous rocks, thereby providing an easy way of escape for the accompanying mineral-bearing solutions. On the footwall side of the dykes (south side at Pine Hill) mineralisation is not so intense and is confined to the immediate contact. The more important deposits then, occur on the hanging-wall side of the dykes, and are associated with the sill offshoots. At Mt Bischoff the narrow tin-bearing veins intersect all formations, including the porphyry dykes and sills, and continue for long distances without perceptible deflection from their course. These have their counterpart in the Pine Hill area where veins containing tin ore in profitable proportion intersect the dykes and sills. They are marked by the almost complete silicification and partial topazisation of the quartz-felspar porphyry wallrock.

It is not expected that the Pine Hill area will prove to be comparable in importance with the renowned Brown Face deposit of Mount Bischoff, but the indications are very encouraging, and the necessary exploratory work should be undertaken as soon as possible.

THE WORK OF EXPLORATION

The location of the ore body from which the boulders of tin ore were shed may be ascertained by one of three methods, namely:-

1. The removal of the covering of talus materials by sluicing;
2. Sinking through the talus;
3. Crosscutting southward from Heywood's section.

The first appears the most simple and expeditious way, but there are two objections to this method. One is the difficulty in obtaining an adequate water supply; the other is the possibility of mistaking the false for the true bottom of decomposed basic rock.

Sinking through the talus is risky because the ore body may not prove to be very wide and there is no definite indication at surface. Moreover, the inflow of water would prove troublesome.

Crosscutting in a southerly direction from Heywood's section or from a point on the side of Gormanston Creek immediately below the northern boundary thereof, is considered the best way of attack. The bedrock, consisting largely of clayey materials (decomposed basic rock) is very soft and could be penetrated by adit at the rate of 1 foot per man per day.

CONCLUSION

From the foregoing account it will be seen that with a small outlay the hidden ore body can be located and explored. The indications are that the ore body is of replacement-fissure type, sulphidic in character, and fairly large. The specimens obtained in sluicing the talus material clearly show that the replaced rock was either pyroxenite or gabbro, that the marcasite ore was originally one consisting of pyrrhotite, and that the source is nearby.

This is another instance of the peculiar association of tin ore deposits with basic igneous rocks in contact with quartz-felspar porphyry.

As a small sum only is required to test the value of the deposit and the prospects of success are so favourable, the necessary work is justifiable.

A. McIntosh Reid.
GOVERNMENT GEOLOGIST.

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