

GEOLOGICAL SURVEY REPORT
ON THE DUNDAS MINERAL FIELDSUMMARY

A statement in brief of the practical consideration arising from the survey of the Geologic relations and of the various kinds of ore-bodies should prove acceptable and helpful to the prospector. This account of the results so obtained presents in condensed form the salient features of the discussion that follows.

The nature of the rocks and their relation are favourable to ore deposition in some parts, but not in others where the conditions are different. This fact emphasises the necessity for close attention to detail in the work of Geologic interpretation.

The rocks will be dealt with in the order of their formation beginning with the pre-Cambrian. These are schists, almost barren of minerals, occupying a small area fronting Mt. Dundas. The next succeeding formation consists of Cambro-Ordovician sediments and tuffs of the Dundas and Bischoff series which occupy the greater part of the district. No ore deposits of any considerable extent have been found in the Dundas series of rocks except where they are intruded by gabbro, serpentine or quartz and felspar porphyries. The Bischoff series of rocks on the other hand are the repositories or hosts of nearly all the lodes. The reason of this is not difficult of explanation. Pre-Cambrian schists and the sediments and tuffs of the Dundas series are comparatively plastic rocks incompetent to withstand compressive and tensional forces, while the hard quartzite, sandstone and slates of the Bischoff series are strongly resistant rocks and fracture under great strain providing channels of access for mineralising solutions. It is interesting to note that similar conditions obtained at Waratah, where the Magnet Silver-Lead Lode and the Mt. Bischoff Tin Lodes occur in the Bischoff series near the line of junction with the Dundas series of rocks. The next in succession are Ordovician Read-Rosebery schists which are favourable to the deposition of ores by replacement. In them are found few true fissure veins but many important fissure replacement lodes. Although the aforementioned rocks contain nearly all the ore-bodies they are not responsible for them. The serpentine, gabbro and quartz felspar porphyry, which crop out locally and with granite probably extend beneath a great part of the area, are the direct cause of mineralisation. From the basic igneous rocks (serpentine and gabbro) are derived the deposits of osmiridium and copper-nickel ore, from the porphyries tin arsenic and bismuth ores, and from the underlying granites silver, lead, zinc and antimony. Talc and chrysolite are derived from serpentine by alteration due to the action of solutions emanating from a granite reservoir. Serpentine and gabbro intruded the sediments prior to the granite and porphyry and have since been transformed in some places into other rock compounds. The common product of serpentine alteration is the so-called dolomite, but much dolomite and its associate mangano siderite were deposited from

solution in lode form. The brownish-black ferro-manganese oxides, forming large ore-bodies, having been derived from mangano-siderite are not carriers of tin ore which is looked for in limonite derived from pyrite or pyrrhotite. The various secondary ores of lead, namely, cerussite, crocoite, pyromorphite, etc., are alteration products of galena deposited in cavities in the gossan. Secondly enriched ores may be found near water-level, but below that line the primary mangano-siderite are not very rich in galena or in any other mineral of commercial value. The oxidation product ferro-manganese gossan is a valuable basis flux, and contains a little lead and silver. Ores of this kind, however, are of local value only.

INTRODUCTION

Preliminary Statement

Mining activity in Dundas District began soon after the discovery in the eighties of the rich silver-lead deposits in the Zeehan district which is six miles west of this field. From Zeehan is a centre prospectors spread into the surrounding country, searching every hill and valley for outcrops of silver-lead ore with a thoroughness that has never since been equalled in these districts. Some of them in due course reached Dundas and soon found silver bearing ironstone cappings of lead ore deposits. Nearly all the known ore-bodies were discovered by the early prospectors, and some were explored by them at depth by way of shaft and adit. During the early exploration period small shipments of rich ore were made to markets overseas, but it was found that the greater number of the deposits were of low grade and two or three mines only survived the boom. Operations on the low-grade ore-bodies began over a decade later with the erection of a smelting plant near Zeehan. They were worked not so much for their content of lead and silver as for their value as basic fluxes. The failure of the Tasmanian Smelting Company caused the abandonment of nearly all the mines in the district.

A recent discovery of tin ore and the re-opening of two important zinc-lead mines has given an impetus to the industry, and the prospects are now much brighter.

General Statement

This report embodies the results of a ten weeks survey of the field during the summer of 1924. The mineral chart of the district, drawn to a scale of 20 chains to one inch, was used as a foundation for the geological map which accompanies this report. Very few of the old mines and prospects were accessible at the time of this visit, and as no records were kept the information available concerning them is rather scanty. However, the descriptions of lode types are applicable to mine groups and will serve to convey an idea of the nature, extent and value of the deposits. The information relating to the lode types embodied herein should prove of very considerable assistance to those engaged in the mining industry, especially to prospectors who desire to know which are the most favourable areas for attention, and under what conditions the ores are likely to be found.

Previous Literature

The literature on the Geology and ore deposits of the field is very meagre, although adjacent fields have been carefully studied and described. No attempt had heretofore been made to prepare a geologic map of the district. During the early days of the field Government Geologists paid hurried visits and reported progress of mining development to the Secretary for Mines.

The following is a list of the reports on the mines and prospects of the field:-

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| Montgomery, A. | Report of the State of the Mining Industry on the West Coast, April, 1890. |
| Montgomery, A. | Report on the Mt. Zeehan and Mt. Dundas Silver-Lead Fields, November, 1890. |
| Montgomery, A. | Report on the progress of the Mining Fields of the County of Montage, 20th May, 1893. |
| Montgomery, A. | Report on the Zeehan-Dundas Mineral Fields in February, 1896. |
| Twelvetrees, W.H. | Report on the Mineral Districts of Zeehan and Neighbourhood, 27th October, 1900. |

These brief reports constitute the whole official literature description of the field.

Production

No official records have been kept of the production of minerals from this district. Mining properties have changed ownership and have been abandoned so many times that the records of production of individual mines have also been lost. Based on incomplete statistics it is estimated that since the year 1890 not less than £500,000 worth of ores has been mined. Production of metals on a commercial scale, however, began in 1890. There have been several periods of depression coinciding with the collapse of the silver and lead markets and the several stoppage of smelting operations at Zeehan. At the present time only one mine is in operation and, although profitably operated, the output is very small. Lead ores are the most important product of the district, but in quantity the production of ferromanganese gossan containing a little lead and silver far exceeds that of any other ore. This gossan was treated to the Zeehan Smelters at the rate of 200 tons per day and was used as a basic flux. During a short period copper-nickel ore, £16,000 in value, was mined and shipped to Europe. Tin ore, after lead, has been the chief product of the district, but the tonnage and value of the output are not known. Antimony, arsenic and zinc ores have been mined on a small scale. Talc and chrysolite may become marketable products of the district very soon.

GEOGRAPHY

Situation and Access

Dundas is connected by rail with Zeehan and with the seaports of Strahan and Burnie. Zeehan which has a population of 2,000, is the largest settlement in the division and is only six miles distant. Strahan is 34 miles and Burnie is 94 miles away. A weekly service only is now maintained between Zeehan and the almost deserted township of Dundas. A road connects the township but is passable for heavy vehicles only.

Climate and General Features

The area is one of abundant rainfall, and most of the valleys are occupied by perennial streams which have their source in the Dundas Range. The township is situated in a broad flat basin which receives all the drainage on the western side of the mountain. From the levels of the piedmont the mountains rise abruptly over 3,000 feet presented deeply serrated flanks on the west and north sides. The streams flow rapidly to the level of Henty plain thence the rate of fall is slow and even. Rapid erosion, however, is now proceeding in nearly all the quarters.

A thick forest growth covers the flanks and summit of the range and button-rush and scrub cover the plains. Eucalypts of various kinds and fagus are abundant, but the chief wood of the district is King William pine which is found above the 2,000 feet contour.

GEOLOGY

The rock formations of Dundas are many and varied, both sedimentary and igneous of several ages being represented. The Dundas series of Cambro-Ordovician slates, breccias, tuffs, etc., occupy the greater part and rest upon intensely metamorphosed schists, slates and quartzites of pre-Cambrian age. Their base is thus exposed on the west flank of Mt. Dundas. In addition the Bischoff series is also represented and is important in containing most of the valuable ore deposits. The Devonian is represented by quartz-felspar porphyry and by gabbro and serpentine. It is thought that Permo-Carboniferous sediments occur near the summit of Mt. Dundas on the south-western fall. The Mesozoic era is not represented by stratified rocks but dykes and sills of diabase occur and form the crown of the mountain.

Proterozoic Rocks

The rocks of this age comprise hard sericite quartz schists, soft sericite schist and dark mica and argillaceous schists. They are clearly metamorphosed sediments which in places have been intensely crumpled and otherwise deformed. The only exposure is on the north western front of Mt. Dundas where they may be seen dipping at a high angle to the south west underneath the Palaeozoic sediments, but they outcrop again in the south eastern side of the range outside this district.

Palaeozoic Rocks
Cambro-Ordovician
Bischoff Series

Directly succeeding, but unconformable with the Proterozoic schists is a series of grey and black fissile slates, sandstone, conglomerates, and quartzite which bear a remarkable resemblance of the Bischoff sediments, but whereas in the Waratah District the series appears younger than the Dundas, here it is definitely older and apparently one is discordant with the other. In this series of sediments nearly all the ore bodies occur.

Dundas Series

This suite of rocks indefinitely assigned to the Cambro-Ordovician has already been described in earlier publications, but there are here certain members not persistent in the formation that require special mention. This remark refers particularly to igneous members that are not found in the Bischoff series. Both acidic and basic rocks, probably belonging to the "porphyroid" group, occur and both are intrusive into the sedimentary members. They are briefly described in a later section, but, in addition to the intrusives there are embedded deposits of pyroclastic material similar to that found in the neighbouring Read-Rosebery district.

This series consists of grey and black slates and quartzites, quartz, schists and slate conglomerates, tuffs and breccias, red and purple chert conglomerate and pyroclastic materials of acidic and basic character.

Igneous Rocks
Porphyroid Series

Rocks of this series occupy the backbone of Dundas Range. They intrude Cambro-Ordovician sediments, and course in a north-westerly direction in conformity with the structural axes of the intruded rocks. The typical rock is of a dull greenish grey tint, yellowish brown on weathered surfaces. It consists of phenocrysts of quartz set in a groundmass of chloritised and kaolinised felspar. The leucoxene alteration product of ilmenite is a prominent accessory component.

This rock is typical of the series occurring in the Read-Rosebery and Mt. Farrell Districts.

Serpentine

The olivine-rich basic rock, peridotite, was transformed into serpentine shortly after its injection as dykes into the overlying rocks. At Dundas the serpentine dyke is over half a mile in width and is well exposed in the central area, but southward the covering of sedimentary rocks is removed in parts only. It is part of a great intrusive body extending north and south many miles. This beautiful sea-green rock is the most striking geological feature of the district, not only because of its physical attractiveness but because the most important ore-bodies are closely associated with it. Accompanying the serpentine as original accessory components of its parent peridotite are chromite,

picolite, osmiridium and gold. Small crystals of chromite are scattered through the serpentine in every part of its body. Picolite is not as plentiful, and osmiridium and gold are sporadic in distribution.

Quartz-Felspar Porphyry

In the Pine Hill and Renison Bell areas a porphyritic rock consisting of phenocrysts of quartz and felspars (orthoclase and objoclase) with a little muscovite and biotite set in a groundmass of felspar and quartz. The accessory constituents zenxite, sericite, cassiterite, pyrite of later formation are developed in some parts of the porphyry body. Veins of pegmatic are common at Pine Hill and are tin-bearing as a rule. Orthoclase alteration into pinite is particularly noticeable at Pine Hill where the soft Kaolin-like substance occurs in large masses underneath porphyry talus. A sample of the material consisted of:-

Silica	42.00 per cent
Ferric Oxide	2.29 per cent
Titania	2.00 per cent
Lime	0.32 per cent
Magnesia	0.43 per cent
Potash etc.	14.90 per cent
Alumina	39.39 per cent

Diabase

Diabase occurs here in the forms of dykes and sills, One dyke, ten to twenty feet in width, outcrops on the summit of Carbine Hill and is exposed at the point where the track crosses it. The dyke trends through rocks of the Dundas series, cropping here and there along its course towards Confidence Saddle. In a cutting on Wallaces tramway it is seen in contact with quartz conglomerate. At that point it appears as a hard, dark grey rock of fine grained texture and conchoidal fracture. It breaks into splintery pieces with sharp cutting edges and which give a sharp metallic sound against iron or steel. Large boulders of diabase are found in many creeks on the valley sides near the mine of that name. The occurrence suggests the near presence of another dyke for boulders in such numbers are not found higher up stream. A remnant of a large sill of diabase forms the crown of Mt. Dundas. It is an extensive body about 400 feet thick. On the north side it rests on porphyroid intrusives and Dundas slates, but on the south it is reported that the base is Permo-Carboniferous mudstone.

Geologic Structure

The Proterozoic and Palaeozoic rocks are folded in anticlines and synclines having northwest axes. Some of the anticlines corresponds with existing ridges and mountains, the most noticeable being that of Dundas Range. The Schist exposure reveals a south-westerly dip, but in the adjacent district to the north-east it is in the opposite direction. Sharply folded quartzites, sandstones and slates succeed them followed by the less deformed rocks of the Dundas Series. Recurring resistant rocks,

such as conglomerates and quartzites, mark the axial intervals. The trend of the several intrusive bodies is generally that of the structural axes, but a transverse body of gabbro occurs at the northern end of the basic belt. Ordovician porphyrites, Devonian serpentines and gabbros, and Mesozoic diabase all trend in a north-westerly direction. Nearly all the veins and lodes likewise course in that direction, but a few bear a little east of north. The north-westerly lodes dip to the south-west and the north-easterly to the south-east. All the important bodies not directly in contact with the intrusives are found in the lower quartzites and slates.

ORE DEPOSITS

Mineralogy

Ores of divers kinds occur in this district, and although formed under different conditions they are not unrelated in origin. Some are peculiar to Dundas; others, known elsewhere as mineralogical curiosities, are wonderfully developed here. Some of the secondary minerals are exquisitely beautiful and are valuable because of their rarity also. In the description that follows minerals are classed as primary or secondary, and are grouped according to composition. Secondary minerals are derived from primary minerals, the change being effected in most cases by the agency of surface solutions. Thus secondary minerals are found in the zone of oxidation or upper part of ore-bodies and primary occur in the lower part where surface solutions have not penetrated. Between these two zones is a transition zone where both classes of minerals are present. Secondary minerals are formed also by the action of ascending solutions on ores and rock-forming minerals, many of which are found in this district. As a rule the primary are commercially more important.

Lead Ores

Primary

Galena - Lead Sulphide (PbS) is the most import primary ore. It commonly occurs in crystalline massive form associated with sphalerite in fissures and replacement bodies.

Jamesonite - Sulphide of lead and antimony ($2 PbS Sb_2 S_3$) is found as a filling of fissures in slates and quartzites. In some of the metalliferous veins jamesonite is the dominant ore of lead.

Secondary

Anglesite - Lead sulphate ($PbSO_4$) is an alteration product of galena by oxidation. In the Dundas ore-bodies anglesite is not common.

Cerussite - Lead Carbonate ($Pb CO_3$) in wonderfully developed crystal masses is abundant in replacement ore-bodies contained in dolomitised serpentine. The crystals are often acicular and of extreme delicacy, pellucid or snow-white, stellate or in long columnar clusters and set in cavities

formed in black ferro-manganese gossan. Large vughs are commonly found completely lined with beautifully developed crystals. It is found also as a thin coating on its parent galena, from which it was formed by the action of carbonic acid derived from a dolomite or manganesiderite gangue.

Chromiferous cerussite - This variety is fairly abundant filling fractures and vughs in gossan and is invariably associated with crocoite. On the contrary it is never found associated with ordinary cerussite. It is an opaque, canary yellow mineral and is of shining lustre. The variety is distinct as regards colour, composition and crystallisation. Its occurrence with crocoite and its contemporaneous formation therewith indicates the nature of the solutions responsible for its development.

Crocoite - The brilliantly coloured chromate of lead ($Pb CrO_4$) occur here in almost perfect crystal form and in very great abundance. It usually occurs in clusters of crystals filling large cavities in ferro-manganese gossan, but also intimately associated with limonite. The most important bodies, both as regards quantity and quality, occur at the Dundas Extended, West Comet and Adelaide Mines when crystals of hyacinth-red and deep scarlet colour, 10 to 12 centimetres long, with perfect terminations, are found in vughs and sometimes mixed with masses of chalcophanite and manganese oxides.

Dundasite - This is a local mineral found as an incrustation on ferro-manganese gossan at the Adelaide Mine. It occurs in small spherical aggregates showing an extremely fine radiating structure. The composition is:-

Pb O	41.86	per cent
Al ₂ O ₃	26.06	" "
Fe ₂ O ₃	5.50	" "
H ₂ O x CO ₂	28.08	" "

and the corresponding formula, omitting the $Fe_2 O_3$ which is regarded as foreign to the substance, is $PbO Al_2O_3 2CO_2 4H_2O$.

Phromorphite - A chlorophosphate of lead is dark green crystallised masses is a common but unimportant ore of lead found in the Comet and Maetries Mines.

Massicot - A yellow oxide of lead found in association with galena, cerussite and anglesite at the Comet Mine. It occurs massive and as a powdery coating on other lead ores and sometimes intermixed with the oxides of iron and antimony.

Phosgenite - This chlorocarbonate of lead ($Pb Cl_2 Pb CO_3$) is a pale to pure white, translucent mineral with adamantine lustre. Many fine specimens have been obtained at the Comet and Adelaide Mines.

Minium - The red oxide of lead occurs as a pulverulent coating on other lead minerals at the Adelaide Mine.

Melanchroite - A basic chromate of lead, differing from crocoite in its darker red colour and brick-red streak, occurs at the Adelaide Mine.

Embolite - A chlorobromide of silver found in limited quantity is ferro-manganese gossan at the west Comet and Central Dundas Mines.

Zinc Ores

Primary

Sphalerite - This is the chief ore of zinc and is found always associated with galena. The more important deposits are on the Great South Comet and Kosminiski properties.

Secondary

Chalcophanite - This hydrated oxide of manganese and zinc occurs in small tabular rhombohedral crystals, commonly in botryoidal masses. At the Comet and other mines it forms an intense brilliantly black coating on ferro-manganese gossan.

Tin Ores

Primary

Cassiterite - The common ore of tin occurs at the Razorback Mine associated with pyrrhotite and arsenopyrite and at Pine Hill in quartz-felspar porphyry associated with Zenxite.

Nickel Ores

Primary

Pentlandite - This sulphide of iron and nickel is found in abundance with pyrrhotite and chalcopyrite at Leslie Junction and at the Dundas Cuni Mines.

Secondary

Millerite - A secondary sulphide of nickel occurring in the form of delicate brass-like fibres with pentlandite near Leslie Junction.

Zaratite - This beautiful dark green carbonate of nickel is found in serpentine at the Razorback Mine, at Moore Pimple and at Dundas Cuni Mine.

Bismuth Ores

Primary

Bismuthenite - This trisulphide of bismuth is found at the South Curtin-Davis Mine and at the Hecla Mine.

Secondary

Bismite - The oxide of bismuth occurs in small quantity at the Curtin-Davis Mine.

Copper Ores

Primary

Chalcopyrite - This mineral occurs in association with Pentlandite at the Dundas-Cuni Mines and is widely distributed but in small quantity.

Tetrahidrite - A fairly abundant mineral found in the Curtin-Davis group of Mines.

Secondary

Malachite - The green carbonate of copper is widely distributed in small proportion.

Azurite - The blue carbonate of copper found commonly in association with malachite.

Arsenic Ores

Primary

Arsenopyrite - Commonly associated with tin ore, in comparative abundance at the Razorback and Fraser Creek Mines.

Secondary

Arsenolite - While arsenious acid is a common alteration product of arsenopyrite found at the Razorback Mine.

Orpiment - The arsenic trisulphide in reinform masses is found in the arsenic-pyritic tin ore at the Razorback Mine.

Iron Ores

Primary

Pyrite - A component of nearly all the sulphide ore-bodies.

Pyrrhotite - The magnetic iron sulphide occurs in great abundance with pentlandite at the Dundas-Cuni Mines, with cassiterite at the Razorback Mine and with arsenopyrite at Fraser Creek.

Manganosiderite - Carbonate of iron and manganese forms a great part of the large ore-bodies at the Comet, West Comet, Mackstries and Adelaide Mines.

Secondary

Marcasite - A pyritic alteration product of pyrrhotite well exemplified in the tin ore lode of the Razorback Mine. The transformation takes place at low temperature and out of contact with air.

Ferro-Manganese Gossan - An oxide of iron and manganese forming a large proportion of the oxidised ore-bodies at Dundas.

Turgite - A hydrous sesquioxide of iron found in the Comet Mine. This is a common ore of iron often mistaken for limonite.

Antimony Ores.

Primary

Jamesonite - The sulphantimonite of lead occurs in distinct veins in the eastern quarter of the district. It is the sole primary ore of antimony known here.

Secondary

Bindleimite - This hydrous antimonate of lead, commonly known as "canary" ore, is an abundant component of the ore-bodies at the Comet and Adelaide Mines.

Other Minerals

Serpentine - This mineral resulting from the alteration of basic intrusive rocks occurs here in very large rock masses. It is remarkably both in texture, composition and appearance. The colour varies from yellowish green to leek green, becoming yellowish white on long exposure. The lustre is greasy to pearly and occasionally wax-like. A sample of typical serpentine has the following composition:-

Silica	SiO ₂	40.52 per cent
Ferrous oxide	FeO	0.52 " "
Ferric oxide	Fe ₂ O ₃	4.49 " "
Alumina	Al ₂ O ₃	1.40 " "
Lime	CaO	trace
Magnesia	MgO	40.50 per cent
Water	H ₂ O	13.80 " "

The mineral has not been mined for any purpose.

Retinalite - A massive resinous yellow variety of serpentine occurs at Dundas with the normal rock.

Talc - A soft hydrated silicate of magnesium occurs massive and fibrous in great abundance at the Razorback Mine.

Stichtite - This mineral first discovered at Dundas forms irregularly shaped masses, veins and blebs in serpentine. It is particularly abundant in Stichtite Hill south of the Adelaide Mine, but it occurs also in other parts of the district. In colour it varies from a most beautiful lilac shade to deep purple and presents a strong contrast with the green of the serpentine in which it is contained. On weathered surfaces it is a deep brown. Its hardness is 1.5 and the specific gravity is 2.12.

Small blebs of stichtite often have as a Nucleus minute particles of chromite, crystals of which occur also in the serpentine. As an ornamental stone this would prove of great value were it is not for the presence of hard crystals of chromite which interfere with the development of a high polish.

Analyses show the following composition:-

Cr ₂ O ₃	11.5 per cent	9.20 per cent
Fe ₂ O ₃	9.0 " "	7.00 " "
MgO	36.0 " "	34.76 " "
CO ₂	7.2 " "	5.40 " "
H ₂ O	36.1 " "	30.70 " "
Al ₂ O ₃	- -	5.00 " "
SiO ₂	- -	6.60 " "

In texture the mineral is foliated to compact and sometimes granular. It is known in the amorphous condition only.

Classification

All the primary ore-bodies in this district are of Devonian age. They were derived either from the basic intrusives (serpentine and gabbro) or the immediately succeeding acid intrusives (granite and its offshoot quartz-felspar porphyry)!

The deposits then may be placed in two classes according to age and genesis and may be sub-divided into groups according to the order of their formation, thus:-

Class I

Deposits accompanying serpentine and Gabbro
Subdivision:-

1. Osmiridium and Gold.
2. Nickel and Copper-Nickel.

Class II

Deposits accompanying granite and porphyry
subdivision:-

1. Tin.
2. Arsenic.
3. Bismuth.
4. Antimony-Lead.
5. Silver-Lead-Zinc.

This simple system of classification, convenient though it be, cannot be strictly adhered to as the pres of one group in some cases transcend those of the preceding group.

Genesis

The ores of the district were formed during the great Devonian period of mineralisation and had a common origin. Difference in regard to character are due to differences in the accompanying intrusives and also to differences in the conditions under which they formed and the precise time of their formation. The close association of the ore-bodies with the intrusive rocks clearly indicates their genetic relationship. Ore deposition accompanied and followed the intrusions as is hereinafter shown.

In earlier publications it is shown that the basic group consisting of serpentine, gabbro and pyroxenite and the acidic group consisting of syenite, granite and its offshoot porphyry represent two original differentials of one stock magma and that the basic portion was injected first into the overlying formations. The close genetic relation that exists between the basic and acidic rocks of Devonian age has been remarked so often that the phenomenon requires no further mention. Suffice it to state that the appearance of a member of one group may be taken as an indication of the near presence of a member of the other group, not, however, of necessity as an

outcropping body. Peridotite, bronzitite, their alteration product serpentine, monoclinic pyroxenites and gabbro traverse every quarter of the district, but quartz felspar porphyry in comparatively narrow dykes is the sole representative of the acidic group and is found in the Pine Hill and East Carbine areas only. Now, in the Dundas town area there is no record of an outcrop of granite or porphyry, yet are found minerals of many kinds, tin ore included, which can have been derived only from solutions emanating from an acidic magma. It follows that a granite batholithic body lies at no great depth in the area. In fact, the carbonic acid emanations from underlying granite are responsible for the conversation of original peridotite into serpentine, clay and ironstone. Much of the ironstone covering of the serpentine represents iron oxide set free during the process of transformation and subsequent oxidation. The next stage is illustrated by the conversion of serpentine into chrsitite, talc, dolomite, mangano-siderite, etc. Narrow dykes are completed dolomitised, ~~or~~ ankeritised, larger ones exhibit these alterations along lines of contact and fissures. Dolomite ankerite and mangano-siderite were deposited also from solutions in the larger fissures and subsequently suffered partial replacement by metallic sulphides.

The Shoots

The veins and lodes are not uniformly metalliferous, comparatively short shoots of ore alternating with long barren sections. As a rule the shoots pitch northerly, at angles of 40 to 60 degrees and dip easterly at angles of equal magnitude. Rich shoots are found at the intersection of transverse fault fissures and lode fissures, the dip of the fault giving pitch to the shoots. In some of the large ore-bodies the richest shoots lie across the lode coinciding in direction and position to the intersection of the angle formed by the planes of the lode and fault fissures. Instances occur at the Adelaide Lead Mine and at the Razorback Tin Mine. Some of the lodes are large and continue unbroken 1,000 to 3,000 feet.

Nature of the Mineralising Solutions

The nature and composition of the vein and lode minerals and the metamorphism of the adjacent wallrock indicate the character of the mineralising solutions. Tin laden solutions accompanying the intrusion of quartz felspar porphyry contained abundant fluorine, chlorine and bornite and silica and sulphur as witness of the occurrence of pseudomorphs of cassiterite, zeuxite and green and black tourmaline after felspar and the silicification and pyritisation of the porphyry. Solutions far distant from the intrusions of porphyry, but which emanated from the subjacent parent granite, were predominantly carbonate in the first stage, and alkali-carbonate and chloric in the second stage. They contained much silica, sulphur, iron and manganese and many other common metals.

Metasomatism

This process, applied here in the restricted sense of chemical alteration of a mineral or rock, is recorded in successive stages by a number of rocks of

secondary development. First, there is the transformation of original peridotite to serpentine and clay and ironstone by the action of hot carbonated waters emanating from the granite successor of the basic intrusive. No outcrop of granite is known but its presence is indicated by the development of chrysotile in the serpentine. The next stage of the alteration is that of serpentine to dolomite and diopside, the change being effected by the same agent but under different conditions. Another agent, the Razorback Mine where tin ore occurs along the line of contact between serpentine and Cambro-Ordovician sediments the serpentine has been completely silicified in some parts and converted into talc and into steatitic ironstone in other parts. The remarkable feature about the replacement tin ore deposits is the absence of tourmaline, topaz or any fluorine or boron bearing mineral.

At Pine Hill actinolite and magnetite, partly by metamorphic processes, have been produced from the original basic intrusive by the action of quartz-felspar porphyry and the solutions accompanying it. Applied in the other sense (replacement of a mineral by another through chemical action) the process is exemplified in many of the large ore-bodies. At Pine Hill the felspar phenocrysts of the porphyry intrusive are replaced by cassiterite and tourmaline, or by quartz. Pseudomorphs of cassiterite after orthoclase crystals are very common, and some fine specimens have been obtained. The copper nickel and zinc lead ore-bodies of the Cuni area have been completely replaced by quartz at a depth of 150 feet. The progressive alteration of serpentine by tin-bearing solutions along the line of contact with slates, grits, and conglomerates as exemplified at the Razorback Mine is indicated in the accompanying analyses:-

	Serpentine	Alteration	Products
SiO ₂	40.52	69.08	85.20
FeO	0.52	-	0.39
Fe ₂ O ₃	4.49	3.33	5.95
Al ₂ O ₃	1.40	1.87	2.32
Ca	Trace	Trace	Trace
MgO	40.50	19.75	5.00
H ₂ O	13.80	4.40	2.50
MnO ₂		2.28	

The effect of dolomitisation of basic igneous rocks is exemplified in the following analyses of narrow dyke rocks:-

Silica	48.36	per cent	29.96	per cent
Ferric oxide	6.42	" "	2.43	" "
Ferrous oxide	0.40	" "	6.83	" "
Pyrite	1.41	" "	0.57	" "
Alumina	19.12	" "	9.35	" "
Lime	6.10	" "	15.85	" "
Magnesia	4.71	" "	10.86	" "
Carbonic oxide	9.40	" "	18.10	" "
Loss on ignition	3.90	" "	5.90	" "

Secondary Ores and the Process of Oxidation

As a rule primary ore has been the chief product of the veins and secondary ore of the fissure replacement bodies. Vein fillings are comparatively narrow and are most common in slates and quartzites; fissure replacement bodies occur at or near the contact of serpentine or as replacements of dolomite ankerite or mangano-siderite. Primary ore appears in the outcrop of vein fillings, but not above water level (except in small bunches) in the replacement lodes.

Except in the Dundas-Cuni Quarter secondary sulphides are almost unknown in the district. No zone of sulphide enrichment separates oxidised and primary ore in any of the deeply explored lodes and none may be expected. Ferro-manganese oxides with secondary lead, silver and antimony minerals give place abruptly to galena and antimony-bearing mangano-siderite and the so called dolomite and ankerite. The evidence clearly shows that the secondary minerals within the oxidised ore represent fairly well the average metallic content of the primary materials and that little is due to migration of solutions. It has been remarked that in the western quarter there are copper-nickel as well as zinc-lead deposits secondary sulphides are common. In the description of the Dundas-Cuni lodes reference is made to the fact that the pentlandite-pyrrhotite-chalcopyrite ore is almost completely replaced at a depth of 120 feet by quartz-massive, white and opaque. The replacing quartz in some places reaches the surface where it appears as sinter, thin-celled with implanted pellucid crystals. From some of the shafts that have intersected the ore-bodies the outflowing water contains iron, nickel and silica in solution. This suggests that the process of quartz replacement is still going on. In the adjacent and parallel zinc-lead ore-bodies similar conditions prevail. At a depth of 150 feet the rich galena and sphalerite ores give place to quartz as in the copper-nickel lodes. In parts of these lodes secondary siderite crystallised on the joint faces is implanted with pellucid quartz crystals and rosettes of galena and sphalerite.

The alteration of mangano-siderite to ferro-manganese gossan is due largely to meteoric waters. The process of alteration is as follows - Meteoric water attached the upper portion of the original galena, sphalerite and jamesonite-impregnated mangano-siderite converting it into ferro-manganese gossan setting free any contained silica as quartz. In so doing the waters lost their dissolved oxygen and became carbonated in which condition they readily dissolved ferrous carbonate and manganous carbonate and some of the contained silica and transferred it to lower levels. Surface oxidation having been completed waters charged with atmospheric oxygen percolated downwards, mingled with the iron and manganese solutions previously formed and precipitated ferro-manganese gossan. In this manner also were formed the secondary ores of lead, zinc and antimony, which are distributed through the ferro-manganese gossan and fill cavities therein. It has been estimated that the alteration of mangano-siderite to ferro-manganese gossan is attended by a contraction of 27.5 per cent, whence ferro-manganese gossans are porous, cavernous and vughy and contain incrustations of quartz and secondary metallic minerals. Nearly all the

ferro-manganese gossan bodies are contained in or closely associated with the serpentine intrusive. Now, serpentine is an alteration product of original peridotite in which chromite and picolite occurs as accessory minerals. In the process of alteration these accessory minerals remain in part unaltered and in small part are converted into stichtite. The next stage is the transformation of serpentine into so called dolomite or ankerite, without any perceptible change in the chromian minerals. Dolomite was later attacked by mineral-bearing solutions and replaced by mangano-siderite, metallic sulphides and other minerals. (A portion of the dolomite found here, however, was deposited from solution). Ascending mineralising solutions provided the greater part of the chlorine which was an active agent in the replacement process possibly also in the formation later of secondary minerals. Ores of secondary origin containing chlorine in combination are fairly common in all the large lodes. Under these conditions of ore oxidation the chromite became decomposed and the chromic acid set free entered into combination with lead to form crocoite, melanchroite and chromiferous cerussite. Cerussite, chromiferous cerussite and crocoite were formed in that order. Specimens of crocoite crystals implanted on chromiferous cerussite are common, but cerussite has not been observed associated with crocoite. The silver sulphide of the argentiferous galena was dissolved and redeposited as chloride of silver of which concentrations have been found. It is remarkable that the secondary ores of lead are almost devoid of silver.

MINING

Nickel Ore Mining:

It is only within recent years that the mining of nickel ores has become an established industry in Tasmania. Operations have been performed on a small scale only, but the industry is yet in the first stage of development. As this is the only district in Australia from which Nickel has been produced the occurrence is of more than passing interest. Few nickel lodes of such high grade as that at North Dundas are known. In recognition of this fact the prospector should feel encouraged to persevere in his efforts to discover other and larger bodies in the main body of basic rocks traversing the area. As exploration goes on doubtless other deposits will be found in the country intervening the known deposits and in the neighbourhood.

Attention should be directed to the gabbro, norite and serpentine rocks, for in them or near them the lodes will be found. Although in the Dundas-Cunie area the lodes at 150 ft. depth have been replaced by quartz, encouragement should be given to their exploration below the level of percolating waters.

Silver-Lead Mines:

The mining of lead ores is closely bound with that of silver ores as they are always associated. As a rule the silver content of lead ores is high and the combined ore is of great value. It is generally considered in this district that an ounce of silver to an unit per cent of lead is the average proportion. In the galena ores silver occurs as a sulphide and in thin concentration by machinery through the medium of water at least fifty per cent of the sulphide of silver

is lost. From this it seems that the silver sulphide occurs on the cleavage faces of the galena. In support of this suggestion it has been observed that the loss of silver increases in accordance with the degree of fineness of the crushed and concentrated material. The lead and silver mining industry has passed through many vicissitudes due to fluctuation in market rates and to the suspension of smelting at Zeehan. Influences that have affected the production of lead apply also to that of silver, it having been observed that there is a definite correspondence in the market fluctuations of the two metals. Recent improvements in mining and metallurgic methods are making available much material that formerly was not of commercial value. The much enhanced prices of the metals and the provision of electric power in addition should result in the reopening of many of the mines.

Central Dundas Area
The Comet and Maestries Mines
Area, Situation etc.

These mines, originally operated by two separately organised companies, have lately been controlled by the Comet Tribute Prospecting Syndicate and worked in conjunction. At the time of visit no work of any nature was being performed and the underground workings were inaccessible. These were the foremost producing mines in the district for many years, yet a small portion only of the ore has been removed above the 300 foot level and not any below.

The mines are situated near the Maestries Station, the terminus of the Dundas Railway and are consequently easily accessible. A small part only of the original area is now held under lease: namely, two sections 7632/M and 7633/M, each of 20 acres, charted in the name of A.G. Omant of Devonport.

The Ore-Body

The ore-body coursing north 30° west extends diagonally through the properties and is continuous both ways over 20 chains. It is from 15 to 60 feet in width and dips at 40 to 50 degrees in a south westerly direction. It consists essentially of mangano-siderite and galena, with the upper part altered by the action of meteoric waters. Oxidation extends to a depth of 400 feet or to a point 500 feet above sea-level. The secondary ores developed in this lode are remarkable for their beauty and rarity and most of them have an intrinsic value. It appears that the ore-body is a replacement of dolomitised serpentine. Much dolomite yet remains unaltered, and the secondary ores are largely carbonates and chromates of lead, thereby suggesting a dolomite derivation from an original serpentine. A striking feature is the small proportion of zinc ore in the lode. As a rule the galena is massive and crystalline, coarse in grain and occurs in short shoots, bunches, or as disseminations in the mangano-siderite gangue. In the upper or oxidation zone chloride of silver occurs in concentrations of fairly large size having been derived evidently from the galena during its transportation into cerussite and crocoite which are almost devoid of silver.

Development

The mines have been opened by open-cuts, adits and shafts. Main shaft is 405 feet deep and 280 feet below ground water-level. Ferro-manganese ore was not cut at the 400 foot level, work at this level having been confined to the southern or galena section of the ore-body. Here the lode is 18 feet wide and contains lead, 14 per cent, and silver 12 oz. per ton. At the time ore of this quality was not profitable and operations were then directed to that section lying between the 335 foot level and the surface. The ferro-manganese ore is as rich at the 335 foot level as at any other part, but the proportion of clean galena decreased from the 260 foot level downwards. This decrease in quantity of clean lead ore is partly compensated by a progressive increase in its content of silver. As operations were carried lower and lower the galena although maintaining its average proportion of the mixed ore, became more widely distributed through the gangue materials, and at the time was considered unprofitable. At 180 feet from the surface a body clean galena (lead 70%, silver 40 oz. per ton) 21 feet wide and 20 feet long was cut in a crosscut from the Main shaft. Shoots 5 to 6 feet in width and 40 to 100 feet in length were worked to the 335 foot level. There yet remains between the 350 foot level and the surface an enormous quantity of ferromanganese ore and below that level a very large body of primary ore of unknown extent is available.

Equipment

At one time the mines were well equipped with pumping and winding machinery, milling and concentrating plants and all the accessory machinery required in the profitable operation of a large establishment. All that remains is the skeleton of the milling and concentrating plant and the building in which it is housed.

Power

In the past steam power was used for all purposes. Now it is proposed to employ a pelton wheel operated by water conducted to the summit of the ridge separating the two mines. A water-race has been out and is in a fair state of repair. The water supply is sufficient during winter and could be augmented by diverting other streams into this course for summer requirements.

Productions

The following particulars relating to the production of ore have been furnished by Gerald Ahern, Chemist and (later) Superintendent of the Mines:-

During the period 1891 to 1893 the Comet ore-body was worked by the Maestries Company and a large quantity of ore was produced. Ore, containing 26 per cent lead and silver in the proportion of 35 oz. per ton, was railed to the old smelters near Lake Fisher at the rate of 60 tons per day. When the Smelting Company closed their works the richer sections of the ore-body only were worked and the output was reduced to 50 tons per week of ore consisting of lead 58 per cent,

and containing 38 oz. of silver per ton. Operations ceased in October 1893. At that time 9,000 tons of ore had been sold and 1,000 tons of second grade ore, consisting of 35 per cent. lead and containing 27 oz. of silver per ton, had been stacked.

The Comet Company, during the periods 1894 to 1898 and 1904 to 1913 produced 9,000 tons of first grade lump ore and 12,000 tons of concentrated galena. The first grade ore contained lead in the proportion of 65 per cent and silver at the rate of 41 oz. per ton; The concentrate, 60 per cent lead and silver 37 oz. per ton. In addition over 90,000 tons of ferro-manganese gossan has been mined and shipped to the Smelters at Zeehan for use as a flux for siliceous ores. This ore, valuable also for silver and lead has been a source of considerable revenue. The average content of the material is:-

Iron	38	per	cent
Manganese	12	"	"
Silica	5	"	"
Lead	5	"	"
Silver in the proportion of 2.5 oz. per ton.			

It was worth nine shillings per ton in the railway trucks at Dundas. The greater part of this ore was mined by G. Ahern who paid tribute of 12½ per cent, of the value to the Company. An equal rate was paid also on the value of the galena produced by him. In this way the company received £10,000 in royalties. Production of galena ceased in 1907 owing to the high cost of mining and the low prices of lead and silver. From 1907 to 1913 mining was confined to the ferro-manganese ore-body. The net value of the ores produced exceeds £220,000. At present market rates for these metals the output would have been worth £700,000.

Platt Prospect

Situation

This property is situated at the south-east corner of the Dundas Prospecting Syndicates section (West Comet) it is now held under prospector's licence by Charles Platt who recently discovered another ore-body there.

The Ore-bodies

The lode, not prominent at surface, consists of galena, sphalerite, jamesonite, crocoite and cerussite set in ferro-manganese oxide and quartz. It is a replacement ore-body, the metallic minerals taking the place of dolomite along the line of contact with fresh serpentine. This is the one known occurrence of primary sulphidic ores in dolomite replacement bodies appearing at the outcrop and at such a high elevation. The sulphidic components do not show a progressive increase with increase in depth, nor are they regular in distribution. The ferro-manganese body is about 80 feet in width, but the lead and zinc bearing portion is confined to four feet on the hanging-wall side. The valuable ore occurs in short shoots with a northerly pitch and an easterly dip. The course of the shoots is N 10° E. Another and parallel lode consisting largely of ferro-manganese

gossan lies 200 feet to the East. It contains a fair proportion of crocoite and some bindheimite rich in silver. This lode outcrops strongly at surface and like the other is a replacement dolomite.

Development

Developments on the western ore-body consist of a few shallow pits and an adit crosscut with lateral drifts on the lode. The crosscut on a bearing of 142° intersects the ore-body at 123 feet and enters massive serpentine at 141 feet. The shoot pitches below tunnel level on the north side, but is exposed for 30 feet in the southern drift. A rise exposes two feet of gossanous quartz with crocoite and cerussite and two inches of galena on the footwall. A sample of the galena contained lead in the proportion of 76 per cent and silver at the rate of 103 oz. per ton. The end of the south drift is in fresh serpentine and there is no indication there of the lode or the line of continuation. On the north slope of the hill fifteen chains distant and adit crosscut bearing 125° intersects the eastern ore-body at 48 feet passing through it at 80 feet into decomposed serpentine. Ferro-manganese gossan here contains much crocoite and cerussite. This crosscut was driven to intersect a body of rich bindheimite exposed in an underlay shaft higher up hill. On the eastern side opposite Platt Prospect an adit has been driven and a shaft has been sunk to explore another parallel and similar ore-body. The average course of the adit is 220° and the length is 305 feet. It is considered that the footwall of the lode is 20 feet farther on. The shaft lies a little North of West from the end of the adit and is distant therefrom 110 feet.

General Remarks

The saleable products of these lodes at present are galena and jamesonite, but if the smelting of ores is resumed at Zeehan the secondary ores of lead will become marketable. Moreover, the gangue of ferro-manganese gossan in which the lean ores are contained in a valuable fluxing material. Successful operation depends upon the marketing of all the materials comprising the ore-bodies.

The several lodes may be attacked at depth by means of adit cross-cuts from the north-western side of the hill. An increase in the proportion of lead and zinc ores is not expected at depth.

Anderson Mines

This mine lies between the West Comet and the Adelaide Mines, and is opened by means of a three compartment shaft, 100 feet deep. At surface the ore-body consists of gossan, manganese oxide and quartz and is encased in serpentine. An examination of the material in the dump reveals the presence of crocoite, which, according to report, occurs in considerable abundance at a depth of 50 feet and it is reported also that galena is sporadically distributed through the lode gangue at a lower level. The ore shoot, however, is short and erratic and is not likely to increase in richness nor in size at greater depth.

Adelaide Mine

Area, Situation, etc.

An area of 10 acres enclosing the mine workings is held under lease 7755M by the Comet Prospecting Syndicate No. Liability. The mine is situated $1\frac{1}{2}$ miles south-east of Dundas township and within 5 chains of a branch line of the Dundas Railway.

The Ore-bodies

The lodes on this property were discovered early in the history of the field. They closely resemble the Comet and Maestries lode, but differ in the relative proportions of crocoite and cerussite. Like that ore-body they consist largely of ferro-manganese gossan and are contained in dolomitised serpentine. The proportion of crocoite is far greater and of cerussite much less than in the Comet lode. Crocoite occurs here in such wonderful development that it is mined for exhibition as specimens. Beautifully formed crystals, interlocked, from 3 to 6 inches in length partly full cavities in the gossan. A large part, however, is intermixed with the ferro-manganese ore indicating contemporaneous formation. In the upper part of the ore-bodies crocoite and gossan are the chief components, but melancroite, chromiferous cerussite, dundasite, phosgenite, minimum and bindheimite are not uncommon. Below the zone of oxidation the ore consists of galena, sphalerite, pyrite and jamesonite set in mangano-siderite and associated with dolomite and unaltered serpentine. Much of the dolomite is stained green with chromic acid.

The lodes are 20 to 40 feet in width and over 400 feet in length. They course 15 degrees west of north and dip of east at 50 to 65 degrees.

Development

The lodes are opened by means of three shallow adits and a shaft of three compartments feet deep. They are well exposed above the level of the shaft collar, but at the time of visit the expensive shaft workings were inaccessible. The lower levels are in primary ore, which is of low average grade.

Production and Reserve

Accurate statistics relating to production are not available, the records of the successive operators having been destroyed. It has been computed, however, that the value of the output of galena and crocoite-ferromanganese ore is not less than £50,000. The ore in the lower levels of the mine is not of high grade and at the time of operations was not profitable. In the upper levels a very large quantity of oxidised ore of low grade is available for excavation. This ore is of value only for direct smelting.

Ahern Prospect

On the north side of the tramway leading to the West Comet Mine and opposite the Anderson Shaft an adit was driven on a gossan ore-body by G. Ahern some years ago. The gossan is clayey and light brown in colour, consisting largely of limonite and therefore,

derived from pyritic ore. Lead ore, which is usually associated here with mangano-siderite and its derivative, is not present. It is more likely to contain tin ore, being on the line of the Razorback lode, but samples yielded not a trace of tin. However, as the tin ore on this line occurs at long intervals and in short shoots sections of the lode in this part may prove to be tin-bearing. The lode is encased in serpentine.

Lucky Star or Bonanzo Prospect

This property, now vacant, lies north and adjoining Platt Prospect. The lode contained in hardened sandstone outcrops on the southern extension of Stichtite Hill between two exposures of serpentine. It consists of cerussite, quartz and a little galena and sphalerite contained in ferro-manganese gossan and is opened by three adits. The upper adit passed through the ore-body near the entrance and entered serpentine; the lower adits were not accessible. At the outcrop the ore-body is large (38 feet wide) and is of the Comet and Maestries type. The ore, however, is of low grade and is valuable only for local smelting.

Farther northward an adit has been driven on a galena-blende lode in dolomite on a bearing 55 degrees east of south. The commercially valuable metallic minerals are associated with pyrite and mangano-siderite and are disseminated in blebs and veinlets through the gangue rock. The lode appears at surface as a massive body of ferro-manganese gossan and quartz, the latter in fibrous form, and is contained in contorted grey slate and sandstone. At the time of visit the adit was not accessible and the lode could not be investigated underground at any point.

Great West Comet Mine

Area, Situation, etc.

This mine is enclosed in a 115 acre section held under lease by the Dundas Prospecting Syndicate. It is situated a mile east of Dundas township and is easily accessible by rail or road. The main line of the railway passes through the northern end of the block and a branch of it passes through the southern end to the main workings.

The History of the Development

The West Comet ore-bodies, of which there are two important ones, were worked originally by the Mt. Dundas Prospecting and Mining Company No Liability in the year 1890 and later by the Central Dundas Prospecting Association. In the year 1896 the Comet Mining Company acquired the property and thoroughly explored the ore-bodies to water level. The operations of this Company revealed very large ore-bodies, the main one being 50 to 70 feet in width and over 600 feet in length. At that time the richest ore (galena) only was marketable. The West Comet Company subsequently operated the mine for the ferro-manganese fluxing material of which very large quantities were sent to the Tasmanian Smelting Company's Works at Zeehan. This company ceased operations 15 years ago and little work has been performed since.

The Ore-Bodies

At the outcrops the ore is similar to that of the Comet Mine, except that the lead there occurs as carbonate whereas here it occurs as chromate. The section in main adit shows 322 feet of slate and quartzite, 61 feet of sinery quartz coursing N 20° E and dipping easterly at 45°, 43 feet of ferro-manganese gossan and crocoite and 179 feet of clayey gossan and cellular quartz of little value. The strike of the lode is N 12° W and the dip is easterly at a high angle. The body of sintery quartz at the slate contact represents the complete silicification of serpentine and is a conspicuous feature also of the adjacent Razorback deposits. The clayey gossan and cellular quartz body is a decomposition product of serpentine which at the walls is quite fresh. Montgomery, writing in 1896, states that the rich shoot of gossan, containing chloride of silver, occurring near the surface was not found in the shaft workings, but northward the proportion of crocoite increased and a rich shoot of galena encased in ferro-manganese gossan was revealed. The following analyses recorded in Montgomery's report convey an idea of the composition of the ore mined at that time:-

Nature of Ore	Remarks	Lead per cent	Silver per ton	
			Ozs.	dwt.
Gossan & Galena	Average of 31 bulk samples	31	66	14
Gossan	Average of 18 samples	5	21	18
Gossan & Crocoite	Average of 17 samples	4.5	18	3
Gossan & Canary Ore	Average of 4 samples	8.5	78	12
Gossan & Siderite	Average of 4 samples	13	14	6
Crocoite, Galena & Gossan		6	17	9
Galena		25.5	106	16
Galena		35.0	107	16
Galena	Clean	75.0	107	2
Galena & Gossan	95 tons 8 cwt.	39.0	94	10
Gossan & Cerargyrite	48 tons	10	450	

These results show that the ores are of high quality and that the gossan contains little lead but a fairly large amount of silver. Some of the richest galena was obtained from a winze sunk from the floor of the main adit. The ferro-manganese gossan is the main ore-body and the clayey gossan represents the alteration or decomposition product of serpentine. It may be stated that the greater part of the galena was mined from the deepest workings only 45 feet below water-level. Mining Engineer Genald Ahern reports that

a vein of galena 18 inches in width is showing in the end of the deep workings. Although secondary enrichments of lead and silver ores are not expected at the base of the oxidation zone it is considered that the primary ore will prove to be of fairly high average quality with occasional exceptionally rich shoots.

Mine Workings

In 1890 a low level adit 640 feet in length was driven across the main ore-body. Passing through 322 feet of sharply folded slates and quartzites, and 61 feet of sintery quartz, a large body of ferro-manganese gossan and crocoite was entered. This body proved to be 43 feet in width and the extension of the crosscut exposed a body of clayey gossan on the hanging wall over 100 feet in width. As very little rich ore was discovered, attention was then directed to the other ore-body. Subsequently a shaft was sunk to a depth of 45 feet below water level and the pumping plant stationed at this point allowed the successful mining of the richer shoots of galena at the deepest level. As the mine openings were being extended it was found that the increasing inflow of water gradually overtaxed the pump and operations were suspended. In the year 1896 erected a 12 inch pump in Main drive and sunk a winze below water level. The pump, connected by 200 feet of flat rods was operated by a water-wheel which was effective during winter only. Under these conditions the highest grade ore only could be mined at a profit to the Company. Of late years low grade ore has been excavated in open cuts. Two lodes occur near the eastern boundary of the property and are opened in small cuts on the west bank of the creek. The lodes occur in crushed, highly contorted slates and sandstones and consists largely of galena and siderite. They course N 15° W and dip easterly at 65 degrees. The galena and siderite in intimate association follow the tilted plains of bedding and fill connecting veinlets, which cross at right angles to the dip. Chalcopyrite, sphalerite and quartz are accessory components. The lode formation is four feet in width, but the average content of galena is small. A sample of clean galena contained:-

Lead 71.90 per cent
Silver at the rate of 98 oz. per ton.

On the south bank of the creek and opposite the Main open-cut workings a galena-siderite vein in grey and black slates and grey sandstones is opened by a short adit. The vein represents a crush plane in the rocks and is irregular, in places indistinct and is faulted. The adit courses S 40° W a distance of 15 feet, then follows the fault S 70° W twenty feet, then resumes its original course. A sample of the clear ore, which varies from one to six inches in width, contained:-

Lead 77 per cent
Silver 33 oz. per ton.

In a small creek three chains east of that just described is another vein of similar nature. The galena is associated with sphalerite, siderite and pyrite and occurs as veinlets in graphite slate. The vein material mentioned and quartz appear to conform in strike and dip to the bedding planes of the strata. It is not an important body.

Production

All records of the output have been lost, but a fairly close estimate can be given from information obtained from J.B. Scott, State Mining Engineer, and Gerald Ahern, Chemist and Assayer to the Company. Not less than 500 tons of high grade ores (galena and cerargyrite) has been mined. These ores consisted of lead 70 per cent, silver 70 oz. per ton; and lead 10 per cent, silver 450 oz. per ton. It is estimated that over 50,000 tons of ferro-manganese ore was mined and railed to the smelters at Zeehan. This ore contained - 3 to 6 Oz. silver per ton; 3 to 6 per cent lead; 30 to 40 per cent iron; 11 to 16 per cent manganese; 10 per cent insoluble substances.

Reserve

There is yet, above water-level, a very large reserve of ferro-manganese ore of average grade, a large proportion of which could be removed by open-cutting and quarrying. The primary ore, containing occasional rich shoots of galena, has been mined to a depth of 45 feet only. In this lode 600 feet in length, rich shoots of ore may be expected and probably a large proportion of the main body will prove suitable for treatment in concentration plants.

Red Lead Mine

On the south side of the Adelaide Hill adits have been driven on a ferro-manganese gossan lode containing crocoite and minimum, the red oxide of lead. No rich bodies of ore were discovered in these exploratory works, and the cost of mining and transport was too great to allow of profitable operation.

Lead-Antimony Mines

North Dundas Area

The mining of antimony ores has not been a profitable undertaking and production has been small. Jamesonite, the sulphide of lead and antimony, is the one important ore of antimony occurring in the district. Although this ore contains a high proportion of silver it has not been marketable. Lately a profitable market has been found for antimony-lead ores and in consequence production is likely to become important.

Wallace's Prospect

About 20 chains south of the terminus of the wooden-rail tramway leading from Confidence Saddle a vein of jamesonite outcrops near the summit of a ridge at an elevation of 2,200 feet above sea-level. The vein is contained in slates and quartzites coursing N 30° W, and dipping to the south of west. It has been proved to extend 30 chains on a bearing N 20° W, and on the dip eastward it has been traced 300 feet. The vein filling is 30 inches in width but the walls of the enclosing slates are impregnated with quartz and pyrite two feet or more. The ore consists of massive jamesonite through which are distributed bright laths and needles of the same mineral and blebs of pyrite and quartz. Jamesonite occurs generally as a distinct band with parallel bands of pyrite and quartz, but in places jamesonite and pyrite are intimately associated. A considerable proportion of clean jamesonite can be separated in mining. A

sample of the material consisted in part of:-

Lead	35.6	per cent
Antimony	17.85	" "
Silver	18 oz. 5 dwt.	20 gr. per ton

Insufficient exploratory work has yet not been performed to estimate its value and the prospect of its improvement. However, the facilities for mining are so favourable and the ore body so easily accessible that development could be performed at small cost to the operators.

Johnson Prospect

On the northern fall of Dundas Range another body of jamesonite is exposed on the bank of a small stream. In many respects it is similar to that of Wallace Prospect, but it is not as large nor as well exposed. The conditions here for mining are equally favourable and the prospect is worthy of more attention.

Lead-Zinc Mines

Sphalerite or Zinc Blende, the chief ore of Zinc, is invariably associated with galena and is mined with that mineral. Zinc blende is regarded as detrimental in lead ores not only because it is difficult to separate but because a penalty is imposed on producers if the lead ores contain above a prescribed proportion of Zinc. In some lodes Zinc is the dominant metal component, in others the proportion of lead exceeds that of Zinc. Hitherto zinc ores have been regarded as of no value and have been dumped. Future production will be derived from the mixed lead and zinc sulphides by separating and concentrating machinery, the zinc ore then becoming a valuable by product.

Central Dundas Area

Great South Comet

Area, Situation, etc.

This property consists of two 20 acre sections held under consolidated lease 6459M by the Comet Tribute Prospecting Syndicate N.L. It is situated south-east and adjoining the Kosminsky lease about three miles from the township.

Access

Many years ago tramway connection was made between the mine and a branch line of the Dundas Railway. It is well-graded tramway and although overgrown with scrub, the earthwork is still in good repair but the bridges and culverts have collapsed. The present tributor, J.J. Hill of Zeehan, considered the existing tramway unsuitable to his purpose and proposed to construct a tramway through the adjoining Kosminski property to the summit of the next ridge and convey the crude ore from that point to the Comet Mill by aerial ropeway. The object of this plan is to make use of the mill aforesaid and at the same time deliver the ore at Maestries Station.

Nature and Occurrence of the Ore

In this lode, which is remarkable for its persistency along the strike, the chief ores are galena, sphalerite and jamesonite. They occur in intimate association with siderite and frequently exhibit banded structure. The following order of mineral banding has been observed: jamesonite, sphalerite, jamesonite and siderite, siderite, galena, siderite. More commonly they are intermixed, or distributed with pyrite in blebs, veinlets and bunches through the siderite base. In some parts the sphalerite and galena occurs in distinct bands and can not only be separated easily from the siderite but from one another. Where intermixed the minerals occur in blebs and individual crystalline grains, either coarse or fine, and are easily distinguishable. Galena and sphalerite, predominate jamesonite, pyrite and chalcopyrite being everywhere sub-ordinate. The ores occur in alternate rich and poor shoots and the vein pinches and swells. In one shoot galena is the chief component, in the next sphalerite, in some these minerals are found in equal proportion. The vein has been opened at points along its course a distance of 30 chains. It outcrops boldly as a ferro-manganese body on both sides and summit of a hill rising over 400 feet above the valley floor. The average course is 325° and the dip south-westerly at 60° . The ore-body is contained in slates, sandstones, grits and conglomerates.

Development

The main workings are on the northern side of the hill and comprise three long adits, one shaft, and two connecting winzes. On the southern side of the hill the ore-body has been opened on both sides of Adams Creek by two short adits, where it appears similar in nature and tenor to that on the north side.

No. 3 or Low Level Adit - This is a drift 440 feet in length commenced about 30 feet above creek level. It exposes a two-foot to three foot vein containing shoots of galena and sphalerite in varying proportions. A specimen of this mixed ore contained 21 per cent lead, 15.6 per cent zinc and silver at the rate of 14 oz. per ton. The analysis is of value only as an indication of the comparative proportions of these metals in the higher grade ore. Slopings has been confined to the galena-rich sections of the vein. At the end of the drift the vein material is 3 feet 3 inches in width and consists of sphalerite, galena and pyrite in siderite. At this point sphalerite predominates over the other components.

No. 2 Adit - This likewise is a drift on the vein, 605 feet in length and is 220 feet higher than No. 1 Adit. At 280 feet from the entrance is a winze of unknown depth. Here the ore occurs in shoots some consisting predominantly of sphalerite others of galena. One shoot of zinc ore is nearly 200 feet in length and it is stated, contain zinc in the proportion of 38 per cent.

No. 3 Adit - A little farther south and 165 feet higher No. 3 Adit has been driven on the vein over 200 feet. The ore at this level does not appear to be of equal value to that exposed in the lower adits, but the workings are of smaller dimension and rich shoots may yet be entered as exploration is carried forward.

No. 4 Adit - From the north bank of Adams Creek on the south side of the hill and at the level of No. 2 Adit a vein of similar materials and evidently identical with that exposed on the other side has been driven on northerly a distance of 50 feet. On the other side of the creek another adit leads in a southerly direction. Neither of these adits is at present accessible. The nature and tenor of the ore, however, may be learnt from the dumps. A sample of the mixed ore contained 21.35 per cent, lead, 25.48 per cent zinc and silver at 17 oz. per ton. On the north side of the creek galena predominates, on the south side the vein material consists almost wholly of sphalerite of high grade.

Reserve of Ore

The rather extensive workings have proved the length of the vein over 800 feet and have provided evidence to indicate its existence in the intervening unexplored part. Moreover, these workings show that the vein maintains its width and the quality of its ores to a depth of 400 feet. Allowing for 50 per cent of poor ore it is estimated that 72,000 tons of crude ore is available above No. 1 Adit Level. The average value of the crude ore has not been determined, but the analyses given herein are fairly representative of the quality. The dumps at the entrances to the several adits contain altogether about 1,000 tons of ore of milling grade.

General Remarks

This well developed ore-body has not been successfully explored because galena-sphalerite ore has not been marketable and because the prices of the metals lead and zinc were formerly much lower. Moreover, productions of lead ore were subject to penalties for zinc contamination. At present rates these ores can be mined and treated profitably. It is the intention of the tributor to transport the ore to the Comet Mill and there separate the zinc and lead components of the ore and concentrate them.

Kosminski Property

Area, Situation, etc.

This is a 74 acre section now held under lease by J.J. Hill of Zeehan. It is proposed by the lessee to operate the ore-bodies on this section in conjunction with those on the adjoining Great South Comet property. The Kosminski ore-bodies were worked on a small scale in 1890 and more extensively in later years but the aggregate output was not large.

Nature of the Ore-bodies

Two lodes are known on this property, both coursing N 35° W and dipping SW at 65°. They commence at the creek where the Great South Comet lode ends and possibly the main one marks the faulted extension of that body. The creek follows a fault in the containing strata, but the lateral displacement is not known. The lode material consists of galena, sphalerite, quartz, siderite, pyrite and a little chalcopyrite, in every essential similar to that of the Great South Comet. It is contained in grey and black graphitic slates

bearing 10° and dipping westerly at a high angle. The lode has been traced nearly 20 chains, but it pinches and swells and the ore shoots are short. The eastern lode is much wider, but the proportion of marketable ore is smaller.

Development

The western lode has been opened at three levels by adits 40 to 50 feet apart. No. 3 or low level Adit is a little above creek level and about 300 feet in length. At the entrance the lode materials are poor, but as the adit advances the quality improves and some high grade lead-zinc sulphide ore appears. Rich shoots are short and erratic. Near the end of the adit the lode is laterally displaced and its northward continuation is not known. No. 2 adit exposes 18 inches of ores 100 feet in length, half of it consisting of galena and sphalerite, and half of quartz and mangano-siderite studded with pyrite. In No. 1 Adit it is of equal size and is composed of zinc-lead sulphide and quartz in two distinct bands. The hanging wall is of graphitic slate and the footwall is of quartz resting on grey slate. The quality of the higher grade ore is indicated in the following analysis:-

Lead	55.2 per cent
Zinc	13.18 per cent
Silver	24 oz. 16 dwt. 12 gr. per ton.

Ainslie Mine

A mile southeast of the Comet Mine is a 20 acre section, recently held under lead 7627/M, on which a galena-sphalerite vein has been opened in three adits. This ore-bearing vein was discovered many years ago by one W. Ainslie and a Company was formed to explore the vein at depth. The records of the work of this Company were not available and at the time of visit the mine openings were not accessible. However, the nature of the ore is revealed in the outcrop. It consists of galena, sphalerite, pyrite, siderite and quartz and is contained in an irregular channel cutting across argillaceous schist. At the faulted junction with slates, breccias, conglomerate and quartzites the vein peters out at surface. The vein is worthy of further attention.

Banner Cross Mine

West and adjoining the Ainslie section is a 20 acre block recently held under lease 7628/M. The vein minerals and the nature of the occurrence are almost exactly similar to the Ainslie. Adits, now inaccessible, have been driven to explore the vein along the strike and dip. Apparently developments were not up to expectations, but the extent of the workings show that the vein is of considerable length. In addition to galena, sphalerite, pyrite and siderite, the mineral jamesonite is an important component. The lead, zinc and antimony minerals occur in intimate association and in banded arrangement with the more abundant siderite. The lode varies in width from one to three feet.

Dundas-Cuni Area

Mt. Zeehan (Tasmania) Silver Lead Mines Ltd.

Area, Situation, etc.

On the east side of the Dundas Cuni Nickel Mines are the properties of this Company. They consist of leases 6361/M, 6360/M and 6359/M each of ten acres. Argentiferous galena was discovered here by Wallace Bros. and Ferguson who in 1910 sold their lease of the mining rights to the Company. The operations undertaken on a considerable scale shortly afterwards were unsuccessful.

The Ore-bodies

The several silver-lead veins occur in black and grey slates and tuffs of the Dundas Series. They are closely associated with dykes of serpentine and gabbro which evidently are off shoots of a much larger body of basic igneous rock underlying the sedimentary rocks. The primary ore consists of galena and sphalerite in a siderite gangue. At a depth of 60 feet quartz becomes prominent and at 120 feet secondary quartz almost completely replaces the metallic ores. Secondary galena, sphalerite, quartz and siderite, all crystallised, are commonly found in the upper parts of the ore-bodies. Water-level here is about 530 feet above the sea and apparently all the primary has been replaced at that level. All the lodes both nickel and lead-zinc in this area of low-lying country, have been affected. It is common to find sinerty quartz and blocks of secondary galena and siderite at surface unconnected directly with any ore-body. The ore in the veins occur in short shodts at long intervals.

Development

Underground works are extensive to a depth of 120 feet. The only means of attacking these veins is by shaft openings aided by heavy pumping machinery. The inflow of water is at the rate of 60,000 gallons per hour, increasing as the mine openings are extended. Overcoming this difficulty proved a severe handicap in the operations of the Company.

Allen Prospect

On the same vein line a little further south shafts were sunk on a body of galena, which petered out at a shallow depth. Nearby a large slab of secondary galena, 8 feet long, three feet wide and 6 inches thick, was found at surface. It is evident that the ore at this point has been leached and redeposited near the surface.

McKimmie Mine

The description given of the veins of the Mt. Zeehan Company's properties is applicable also to this vein. At the outcrop a body of rich galena in black slate gave promise of continuance at depth, but at 50 feet quartz and siderite became prominent and at 70 feet occupied the vein channel. A very large influx of water hampered operations.

Other Prospects

About 12 chains west of the Five Mile Station is a pyromorphite vein, 9 inches in width, which has been exposed in trenches and shallow shafts. Another vein two chains farther on contains, besides pyromorphite, a fair proportion of cerargyrite. In the section north west of that just referred to a trench in decomposed gabbro and black slate exposes a well-defined lode containing niccolite (arsenide of nickel), galena and sphalerite. At surface the solid niccolite patch was 6 feet long and 1 foot wide tapering out at a depth of 10 feet, but a little niccolite remained in the puggy lode matter to the bottom of the shaft.

North Dundas Area

Kapi Mine

The Northeast Dundas Tramway from Zeehan, between the 8½ and 10 mile pegs, is out through two sections, leases 8682/M and 8980/M, charted in the names of G.W.D. Hamilton and G.V. Chapman. These sections enclose the workings of what is unknown as the Kapi Mine. For many years the Kapi has produced high grade galena in fairly large quantity. The lodes are of the galena-sphalerite type and the gangue rocks are siderite and dolomite. They are contained in Dundas Slates and quartzites and are very persistent. Ore shoots, however, are short and vary greatly in size.

Bismuth-Lead-Copper Mines

Marking the transition stage between tin and lead ore deposits are certain complex lodes containing bismuthenite and tetrahedrite. In these deposits the minerals association is rather extraordinary. For instance, in the Curtin Davis Group set in a siderite gangue are found bismuthenite, tetrahedrite, chalcopyrite, pyrite, galena, sphalerite, and arsenopyrite, the relative proportions varying in different lodes and in the same lode. The veins are fairly persistent in their strike, generally a few degrees W of N, but none is of any considerable size. They are contained in the Dundas series of the Cambro-Ordovician rocks in which large ore-bodies are not found, except those in direct contact with dykes of serpentine or porphyry. Some of the veins, especially those containing tetrahedrite (fahl ore), are very rich in silver, picked samples having assayed nearly 3,000 oz. per ton. The rich shoots, however, are very small and the mining of these ores has not been commercially successful.

North Dundas Area

Heckla Mine

Lease 7402/M - 80 Acres

This ore-body, which was discovered many years ago, marks the transition stage between tin and lead deposits. It is not of any present economic importance nor is it likely to improve in value, yet it is one of very great interest.

Situation, etc.

The Northeast Dundas Tramway passes across the northern boundary of the lease near the bridge

over Great Northern Creek. It is easily accessible and only 12½ miles from Zeehan.

The Ore-body

The lode components are chalcopyrite, bismuthenite, pyrrhotite, and pyrite set in a matrix of siderite. There does not appear to have been any particular order of deposition, but chalcopyrite and bismuthenite, always in intimate association, are found in reticulating veinlets traversing siderite. Long disconnected accircular crystals of bismuthenite are scattered through siderite. Pyrrhotite is not prominent, but pyrite is abundant. Carbonate of bismuth and copper are common secondary minerals.

Development

No. 1 Adit, over 200 feet in length and bearing 5.7° W to S 14° W, is the chief mine opening. It enters cliff of slate and grit overlooking the bridge crossing Great Northern Creek. At 90 feet from the entrance a winze has been sunk from the floor of the drift and at 110 feet another winze has been cut a few feet wide into the floor. Here the lode is 27 inches wide and consists largely of siderite, but carries a little copper and bismuth. A bulk sample contained:-

Silver	5 oz. 0 dwt. 15 gr. per ton.
Copper	0.85 per cent.
Bismuth	1.28 " "

Farther on the vein becomes thinner through well defined and at the end of the drift consists of a 6 inch and a 3 inch band separated by three feet of slate. The vein is sharply defined throughout and is contained between two clean cut walls. Sloping has been carried up to 20 feet. A bulk sample of the ore in the dump at the entrance contained:-

Copper	2.85 per cent
Bismuth	2.77 " "
Silver	25 oz. 4 dwt. 8 gr. per ton.

The lode is cut again just above the railway on the east side of the bridge and is exposed in an adit 60 feet in length. At the entrance the ore-body is 4 feet wide and dips westerly at 82°. It consists largely of pyrite, pyrrhotite, and chalcopyrite and contains a little arsenopyrite and bismuthenite. The clean material is hard and dense. A large part consists of disseminated ore in slate and schistose grit. Traces only of the vein appear in the railway cuttings.

Fraser Creek Mine

Lease 6294/M - 80 Acres

The lode on this property was originally worked for its contents of tin ore by James Dwyer and later by R. Ruggeri. A block of ore weighing three tons found by Dwyer contained tin in the proportion of 12½ per cent. The lode from which the loose ore had been shed was unearthed and opened by means of a shaft adit. It was found that the ore-bodies consisted largely of arsenopyrite and that the average content of tin ore was small. Ruggeri sold his lease of the mining rights to the Edwards Metallurgical Company of Ballarat who produced a large quantity of

arsenopyrite in the subsequent operations. The mine was ultimately abandoned by the Company.

Situation and Access

The mine is situated in the valley of Fraser Creek, immediately below Fraser Station of the North-East Dundas Tramway by which it is easily accessible from Zeehan, 14 miles distant.

The Ore-body

The ore-body is of the pyrrhotite-cassiterite type and contains also the primary minerals arsenopyrite, chalcopyrite and quartz. In some sections arsenopyrite in others quartz dominates all other components. In the upper workings marcasite takes the place of pyrrhotite, pyrite is nowhere prominent. The order of deposition is not easily distinguishable. Pyrrhotite, arsenopyrite and chalcopyrite appear in intimate association, the first apparently preceding the others. Some of the quartz is studded with arsenopyrite. Perfectly formed pellucid crystals of quartz with implanted crystals of arsenopyrite are common. As a rule the quartz is white opaque or smoky in colour. The lode courses north 23 degrees west and dips north-westerly at angles of 70 to 85 degrees. The slates in which the lode is contained strike N 20° E and are nearly vertical.

Development

The lode has been explored by means of five adits and long lateral drifts. It has been proved to extent a distance of 500 feet and to maintain an average width of two feet. No. 1 adit exposes six to eighteen inches of ore resting on a hard slate footwall a distance of 120 feet. At the entrance quartz is the chief component, gradually giving place to the sulphidic minerals near the end of the adit where arsenopyrite dominates the other components chalcopyrite and marcasite. At the end of the adit the lode is broken. Part of the ore has been stoped. A bulk sample of the ore, one foot wide, contained:-

Gold	Nil.
Silver	2 oz. 12 dwt. 6 gr. per ton.
Arsenic	20.02 per cent.
Copper	0.85 " "
Tin	Nil.

No. 2 Adit is 40 feet lower than No. 1 and south of it. A cross-cut bearing S 65° W intersects the lode at 100 feet whence drifts lead north and south. The drift on the north side follows a clean slate wall 200 feet exposing alternate rich and poor sections. A shoot of ore 134 feet in length has been stoped. At the end of the drift the ore is small and poor. The drift on the south side is 100 feet and exposes a shoot of ore 75 feet in length, the greater part of which is stoped. At the 70 feet a winze was sunk to a depth of 20 feet. The lode peters out in the end. At this level marcasite gives place to the primary mineral pyrrhotite, arsenopyrite predominates, and chalcopyrite is subordinate. N. 3 adit is 30 feet lower than No. 2. The crosscut on the bearing S 60° W intersects the lode at 70 feet and a drift exposes it 15 feet south and 3 feet north of the point of intersection. The ore

consists of arsenopyrite, marcasite, chalcopyrite and quartz, all intimately associated. The following analysis indicates the average composition of the ore:-

Gold	Nil.
Silver	4 oz. 16 dwt. 16 gr.
Arsenic	7.23 per cent.
Copper	4.08 " "
Tin	0.30 " "

No. 4 adit workings lies south of the group described and consists of an 80 feet drift on the lode which in the north end is small and poor. The average width is 18 inches, and the components are arsenopyrite and quartz with pyrrhotite and chalcopyrite. A bulk sample contained:-

Arsenic	16.80 per cent.
Copper	0.09 " "
Tin	trace

No. 5 adit is a small leading from a long trench and is above No. 4 adit. The ore here is predominantly arsenopyritic. In addition to the workings described short adits have been driven on a gossan vein, one from rail level of the tramway, one below it. The ore is poor in its content of tin, silver and gold.

Curtin-Davis Mine

Situation, etc.

This is one of a number of mines opening a series of parallel veins in the neighbourhood of Ringville. It is accessible by the North-East Dundas Tramway and is 15 miles by that route from Zeehan. Not one of these mines is in operation and not one is of any considerable value.

The Ore-bodies

The veins are enclosed in a series of sharply folded slates, quartzites, grits, conglomerates and tuffs, the more important being on the east limb of the anticline. As might be expected the richest ore and the widest part of the vein occurs near the apex of the fold, that is, near the summit of the very steep and high hill. At the lowest level, 1,430 feet below the summit, the ore is very poor and small. Two openings were made in the west limb vein with unsatisfactory results.

Developments

Development works consist of nine adits nearly all of which penetrate the hill from the north side. 100 foot level - this adit, 255 feet in length, exposed a shoot of gossan containing patches of tetrahedrite and chalcopyrite and near the end galena, sphalerite, cerussite and native copper. 180 foot level - This is an adit crosscut which cut the vein at 100 feet. The vein was followed southward 143 feet and was found to consist of similar ore as that at the 100 foot level. 420 foot level - Three shoots of tetrahedrite and siderite were cut in this adit which was driven 465 feet. At the end of the adit the vein material consists almost wholly of carbonate of iron in thin streaks through hard black slate. 560 foot level - At this level the vein has been

exposed 370 feet in length, showing chalcopyrite and tetrahedrite in a siderite gangue. Some high grade ore was obtained, but the bunches were erratically distributed. 680 foot level - The vein at this level is very erratic in its content of the valuable minerals. It is exposed 456 feet in length and peters out at the end of the adit. 840 foot level - The adit at this level was driven a distance of 256 feet on the vein which is from 3 inches to two feet in width and which is contained between slate walls. A little tetrahedrite was obtained. 1,000 foot level - This adit was driven 137 feet on ore containing bismuthenite and silver in gossan. The vein is very small and irregular and consists largely of pyrite near the end of the adit. 1,150 foot level - This is an adit crosscut 123 feet in length. No ore was found at this level. 1,430 foot level - the lode was exposed here 88 feet in length and was found to be barren of any of the commercial minerals. It is quite evident that the operators did not understand the nature of this occurrence. The ore obviously becomes poorer and smaller at depth in veins of this kind. Recurring bodies at the splices of succeeding folds are insignificant because the lower strata are too plastic to allow of fracturing and the formation of channels of percolation. The truncation of the anticline shows that the richest part of the ore-body, namely that at the apex has been removed by erosion.

South-West Curtin-Davis Mines

This vein, which has been traced a long distance at surface, trends 14° E of N and dips to the east at a high angle. It has been opened in two adits, 100 feet apart, the upper one being about 50 feet below the highest outcrop of the ore. On No. 1 adit the vein was cut at 90 feet and driven along 140 feet north and 210 feet south. In the south drive gossan and tetrahedrite of high quality was exposed in a shoot 50 feet in length and 15 feet from the end a short shoot containing a large amount of bismuthenite was cut and stoped. A 40 foot shoot of rich ore was stoped from the level of the north drive, but the vein generally was poor and consisted largely of siderite. The rich ore in the vein varies in width from one to sixteen inches and is contained in very hard slate and conglomerate. Bulk samples of the ore contained 10 to 20 per cent copper and silver at the rate of 150 to 200 oz. per ton. About 600 tons of ore worth £6,000 has been won from this vein.

South Curtin-Davis Mine

Many years ago three adits were driven on a vein consisting largely of tetrahedrite and galena in siderite. In the excavation of these openings about 200 tons of very rich ore was obtained and about 40 tons of clean galena was mined from a branch vein. However, the shoots of rich ore were very patchy and the operations generally were unsuccessful.

Evenden Prospect

A mile south of the Curtin-Davis Mine an adit has been driven from the south bank of a tributary of Great Northern Creek on a galena-sphalerite-pyrite vein encased in slate and sandstone. At the time of visit the workings were not accessible, but from reports

received the ore-body is one worthy of more attention. The content of silver is low, however, and the ore requires treatment by machinery to separate and concentrate the lead and zinc minerals. An advantage is its nearness to Wallace's tramway.

Ramsdale Prospect

South of Evenden Prospect on the Carbide Hill track to Dundas a gossan lode two to three feet in width and coursing N 20° E has been opened in a deep trench and a shaft. Samples of the gossan show a silver content from 30 to 100 oz. per ton. It is a promising lode, but requires further exploration.

Tramway veins

Between Confidence Saddle and the terminus of Wallace tramway a number of narrow veins of galena and siderite are exposed in trenches and short adits. None of them is likely to improve much in size or in mineral content as they are all contained in the rather plastic Dundas series of tuffs and slates.

Carbine Mine

Trenches and adits on two outcrops on the north-western slope of Carbine Hill reveal the nature of the primary ore and the size and extent of the veins. They are from one to ten inches in thickness and course N 60° W. The materials consist largely of galena and siderite with also a little tetradedrite and pyrite. Farther west is a large pyrite lode which contains also jamesonite, tetradedrite, chalcopyrite and sphaerelite. The valuable contents are so sporadic in their distribution that the ore as a whole is of no commercial value.

There is no prospect of these ore-bodies improving appreciably in size or value at any point.

A. McIntosh Reid.
GOVERNMENT GEOLOGIST.

8th October, 1924.