PRELIMINARY REPORT ON THE DEPOSITS OF IRON ORE AT HAMPSHIRE HILLS

INTRODUCTION

Many years ago the late Renison Bell discovered large bodies of magnetite in the valley of Emu River on the Hampshire Hills Estate of the Van Dieman's Land Company, and also the more extensive deposits on Crown land to the east thereof recently acquired by L.J. Smith of Ulverstone. These outcrops were considered, at the time, to be the cappings of silver-lead and tin ore-bodies and quite recently even, some of them have been trenched to ascertain their value as repositories of tin ore. The occurrences near the line of contact between the granite and magnetite-bearing altered limestone rocks contain fluorspar in considerable abundance, thereby suggesting the latter possibility. Traces of tin have been found in the magnetite - poor section of the ore-bodies, but no important deposits have as yet been found in them. However, outside the magnetite area alluvial deposits of tin ore have been worked for many years.

At the time of the systematic investigation of the iron ore resources of Tasmania by the late Mr. W.H. Twelvetrees and the writer, the importance of these deposits was not known to the Geological Survey, and in consequence, reference is not made to them in the publication dealing with that subject issued by the Mines Department.

GEOGRAPHY

The main line of transport between Hampshire and Burnie is provided by the Emu Bay Railway Company. Hampshire Station is 1,500 feet above sea level and is nearly 20 miles from the seaport. It will thus be seen that very little tractine force is required in the conveyance of the ore between these points. The mines, by rail route, are distant only six miles from Hampshire, and the intervening country presents no serious obstacle to railway extension. Along the route of the proposed line, the land surface does not rise above 1,750 feet, but the crossing of Emu River is at the 1,300 feet contour. However, by extending the branch railway to Oonah Siding, one mile nearer Burnie, the grade could be reduced to 1 in 80 against the load.

Burnie is a flourishing town occupying the west and south shores of Emu Bay, one of the most important sea-ports in the northern part of the Island. The protection afforded by a concrete breakwater extending 1,000 feet from the Western headland provides safe mooring for both small and large vessels in all weathers. At Burnie, provision is made for the rapid handling of cargo from the ship's hold direct to railway trucks on the wharf, and vessels may enter and leave port without difficulty except during a very severe storm. Another advantage possessed by this seaport is its comparative nearness to the mainland of Australia.

The surrounding district is famous for the fertility of its basaltic soils and the consequent prosperity of the inhabitants.

PHYSIOGRAPHY

The area under review may be described, briefly, as an elevated plateau traversed by numerous north-flowing streams, of which the Blythe and Emu Rivers are the more important. It constitutes a border portion of the Bischoff peneplain (1,500 to 1,800 feet above sea-level) and here, as there, is covered, in part, with a thin sheet of basaltic lava. Although the old erosion surface, so conspicuous a feature of that area, is not clearly discernible here, the general accordance in levels and the absence of a definite break in the continuity of the plain through the intervening country is considered sufficient proof of their coincidence. Residual mountains of erosion, such as Valentine Peak, Mt. Misery, and Companion Hill, standing out abruptly against the sky-line, have their counterpart in the Bischoff district.

Basalt lava of Tertiary age occupies the valley and bed of Emu River hundreds of feet below outcrops of granite, pyroxenite, limestone and sandstone of early Palaeozoic age, showing that the stream is flowing in a very old erosion channel. The contact of the eruptive rock with the older formations along the course of the stream is clearly exposed in many places. The surface, beneath the lava, in some places, is covered by rubble, much of which is enclosed in the eruptive rock.

In many parts of the area, erosion has completely removed the basalt from the old peneplanated surface, exposing to view sandstones, limestone and slates and the intrusive rocks amphibolite, pyroxenite, and granite, of which the bedrock is constituted. Tin ore, shed by the granite, has collected in placers or alluvial drifts in the deeper valleys, and some of these have proved highly productive.

GEOLOGICAL RELATIONS

The rock formations of the district include a thick series of limestone, sandstones, grits, and conglomerates of Cambro-Ordovician age, which, at the close of the Silurian were invaded, first, by basic rocks consisting largely of amphibolite and then by granite. Both groups of intrusive rocks are well exposed, and because of the intense matamorphism of the sedimentary rocks especially the limestone, the great mass of the granite probably lies not far beneath the surface in the south-easter part.

Diabase, possessing all the characteristics of the intrusive rock of Upper Mesozoic age so prominent in the midland and eastern districts, abuts against the eastern edge of the granite.

Tertiary basalt occupies a large part of the plateau, and also erosion valleysof an older topography.

The basic rock is rather unique. It consists largely of colamnar hornblends or amphibole in lenticular masses and is highly developed. The fresh rock consists of crystals one to six inches in length. To the south-east a peculiar fibrous brown variety occurs.

The granitic rock is remarkable for the absence of the micas. Biotite is prominent near Hampshire Railway Station, but elsewhere its presence in appreciable proportion is unusual. Muscovite is poorly developed and occurs at widely separated points only. The rock consists essentially of orthoclase, an acid plagioclase, and quartz, and is generally of medium grainsize. Dyke rocks associated with the granite batholithic mass include granite porphyrz and aplite. Near contacts quartz - tourmaline is prominent.

THE PROCESS OF INTRUSION AND METAMORPHISM

The intrusive igneous rocks referred to were derived from a common magma which, by differntiation in place, formed the stocks of two groups of rocks, namely: a basic group, now represented by amphibolites, and pyroxenites, and an acidic group, represented by granites. After the completion of the segregation of the basic from the acidic portion of the stock magma disunion was effected by the injection of the comparatively small basic portion into the overlying Cambro-Ordovician sediments. There, further differentiation resulted in the formation of mineral groups now represented by the several containing rock formations. There followed, after a short interval, the intrusion of the acidic or granitic portion of the original stock magma with its accompanying mineralising agents. The affect of the intrusion of the granite on the sediments is not particularly marked, except in the case of the limestone which in many places has been completely transformed. The most important metamorphic affect of the intrusion on the limestone rocks is the development of large bodies of crystalline lime silicate. This change is produced by the action of hot silicated waters on calcium-carbonate. In places, at points of contact for instance, where fluorine-bearing solutions were prominent, garnet, with fluorspar, pyrophyllite, and magnetite, was developed at the expense of the original rock, and dolomite was not formed. It is evident that the variation in the products of metamorphism is due to distinctly different solutions of different composition. The metamorphic ore-bodies are exceptional, in that they occur well within the egneous mass that caused the metamorphism. All gradations from garnet through garnet-magnetite rock to magnetite are represented.

SECTIONS 9065M, 9066M, AND 9067M - L.J. SMITH, LESSEE.

AREA, SITUATION, ETC.

These sections, each of 30 acres, are situatuated six miles east of Hampshire, or Bland, as it is officially designated, a small settlement fronting the Emu Bay Company's railway line which line which connects Zeehan with the port of Burnie. A road leads from the siding three miles towards the mine, and the surveyed route for its extension passes through the property. The route is fairly direct, over gently undulating grasslands, as far as Holloway's sawmill, thence the course over forest-clad granite country is rather tortuous, but the gradient is not heavy on any section. It will thus be seen that the mine under present conditions is easily accessible by railway, road, and track.

THE ORE-BODIES

The sections are almost wholly occupied by altered limestone rocks and by basic rocks consisting largely of amphibolite or and of pyroxenite. This body of limestone rocks is completely incased in granite, but at the southern end the thickness of the casing is very small compared with that on the other three sides. In them are lenticular bodies of magnetite arranged in echelon formation with aureoles of disseminated magnetite in garnet. Solutions emanating from the intrusive granite have greatly affected the limestone rocks, and the magnetite also, especially in the ore-bodies near the granite contact. Along this line conversion into garnet is almost general, and silicification is common. Associated with the garnet is found pellucid and purple fluorspar, perfectly crystallized and in considerable abundance. It is striking to see a rock flecked with magnetite and studded with fluorspar, minerals which, as a rule , are so widely separated and which occur under such dissimilar conditions. Metamorphism is not general even along the line of contact, as instance the fresh and unaltered condition of the small body of basic rock, completely enveloped in granite, lying to the west of Section 9067M. Silicification is prominent near the termini only of the body of limestone rock, and the larger and more important ore-bodies are noticeably uncontaminated. Garnetisation occurs on both sides of the body and extends inwards more than one hundred feet from the border, forming a garnet-magnetite fringe. The composition of the garnetised rock is as follows:-

Silica	SiO_2	20.60	per cent
Ferric oxide	Fe_2O_3	29.89	" "
Ferrons oxide	Fe O	10.37	" "
Alumina	Al_2O_3	17.10	" "
Titania	TiO_2	trace	
Lime	Ca O	21.40	" "
Magnesia	Mg O	0.22	" "
Manganese oxide	Mn O	0.93	" "
Fluorine, etc.	F etc.	0.52	" "

The high proportion of iron is accounted for by the presence of disseminated magnetite ore in the rock. The low content of magnesia is particularly striking.

QUANTITY OF MAGNETITE AVAILABLE

Within the boundaries of these sections there are nine leases of rich ore and two occur over the border. They vary greatly in size, the largest being near the centre of the limestone rock. Their thickness and extent cannot be determined with any degree of exactitude owing to the difficulty in tracing their outlines. This is due to the covering of detritus and clay soil resulting from the disintegration and decomposition of the containing rocks. Bedrock has been exposed at a few

points in trenches, but these openings have been confined to the bodies near the granite which were considered likely to contain ores of tin. The information they reveal is of no value in so far as it concerns the investigation of the magnetite deposits. There are then no criteria upon which an estimate of quantity can be based.

Suffice it to state that these disconnected bodies of magnetite are distributed through the length and breadth of the three 30-acre sections, and that few are less than twenty feet in width and some are much wider.

In addition to the clean ore, large quantities of disseminated ores are available.

QUALITY OF THE ORE

The reason for the difficulty in arriving at an estimate of quantity is experienced again in attempting a determination of the quality of the ore. In all the ore-bodies partial alteration of magnetite to hematite and to limonite, especially, is apparent, but in the centre of the larger bodies the transformation is not so noticeable. It is evident that the alteration becomes less and less as the cover increases, and that the effect of oxidising agents is greater near the sides than in the centre of the body. The more massive the ore the less the alteration, consequently the greatest change is found in the disseminated ores. In extreme cases the conversion to limonite is complete, and this mineral, simulating its parent in lustre and general appearance, is often mistaken for massive magnetite. However, when these bright, limonite-coated boulders are broken, the containing basic rock is seen and their nature is plainly revealed.

No attempt was made to effect a systematic sampling of the ore to determine its value - that was impossible - but the various grades are fairly represented in the table of analysis given hereunder. The purpose of the rough attempt at sampling was to ascertain what proportion of impurities was present in the various grades of the ore. It will be seen from the analyses that the ore, even that affected by atmospheric agents, is of high quality and contains traces only of deleterious substances.

P.A. HOLLOWAY'S 10-ACRE LEASE

Ten chains south of section 9067M is a body of massive magnetite enclosed within the bounds of a ten-acre lease recently secured by P.A. Holloway, of Hampshire. This ore-body is well wxpoded on a wooded hillock projecting thirty feet above a button-rush-covered plain. The outcrop, oval in shape, is about 200 feet long and 100 feet wide, and probably represents the upper surface of an extensive ore-body. The exposed ore is remarkably rich and contains insignificant amounts only of deleterious substances. Large crystals of magnetite in the form of rhombic dodecahedra are very common in the outcropping ore-body.

As an adjunct to the larger ore-bodies on L.J. Smith's sections, this may prove of considerable value.

EMU RIVER ORE-BODY

On the Hampshire Hills Estate of the Van Dieman's Land Company another body of rich magnetite is known. This ore-body is exposed on the right bank of Emu River, half a mile north of Hampshire Railway Station. In every respect the occurrence is similar to that of the ore-bodies already described, being contained in garnetised limestone which is almost wholly inguphed in granite. In this case the ore is undoubtedly a product of contact metamorphism,

The massive ore occurs in two lenticular bodies encased in garnet-magnetite rock. A small opening cut into one body reveals ten feet width of high grade ore; the other has not been exposed by artificial means.

It is quite empossible to estimate their value as sufficient exploratory work has not been performed. Work of that character may be postponed until a commencement is made with the development of the other deposits.

THE COMMERCIAL VALUE OF THE DEPOSITS

In order to arrive at an estimate of the prospective value of these ore-bodies it is necessary to ascertain:-

1. The dimensions of the several deposits.

2. The quality of the ore.

3. The cost of mining and excavation.

4. The cost of transport to the smelter.

With regard to items Nos. 1 and 2, the necessary data can be obtained only by the performance of exploratory work. Under favourable conditions deep trenching across the ore-bodies should suffice, but tunnelling or drilling would be preferable. Having determined the outlines of the several ore-bodies, their depths may be assumed at half their lengths.

3. With one exception (Holloway's) all the ore-bodies can be worked to a depth of 100 feet by means of adits or open-cuts. The ore-body on Holloway's 10-acre

lease should be worked by the quarry method. Those on Smith's sections can be attacked at greatest advantage on the east side from the valley of Holloway Creek. Until the necessary exploratory work has been performed it is impossible to express an opinion as to the best method of operation, and it follows that an estimate of cost of production cannot be attempted.

4. On Government Railways the haulage cost per ton is one penny per mile for coal, and probably a similar charge would be made for the haulage of iron, especially in the handling of large quantities. The rate on the Emu Bay Company's line is not known to the writer, but as the load is with the grade it is not likely to be much higher.

Provision has to be made for the construction of six miles of branch railway from Hampshire siding to the mines.

THE ESTABLISHMENT OF THE IRON AND STEEL INDUSTRY IN TASMANIA

The smelting of iron ores and the manufacture of the products into articles of commerce is a matter of great importance to Tasmania. Many years ago when conditions were not ripe an attempt was made to establish the iron smelting industry at Beaconsfield, and but for the reason that the ores there contained too much chromium, success might have attended the efforts of the operating Companies. (Chromium ores are now in great demand for the manufacture of special steels). At the time the importance of the magnetite and haematite deposits in the western and north-western districts was not known, and it is only within recent years that any sustained attempt has been made to develop them. Of late their value and extent have been carefully estimated.

By reason of its unique geographical position and its many other advantages, Burnie is the natural outlet for the products of many of the iron mines. Moreover, Burnie provides suitable sites for iron and steel smelters. At Wivenhoe, on the east side, and Cooee, on the west, good sites may be found. Wivenhoe is closer to the Blythe, Rutherford, and Dial Range haematite deposits, and is otherwise more favourable. If arrangements could be made to work these haematite deposits in conjunction with the Hampshire magnetite, a never-failing supply would be assured. Limestone, belonging to the same formation as that quarried at Melrose and Railton, of excellent quality and in unlimited quantity, occurs near the North-Western Railway and at Hampshire. The necessary supplies of coke for smelting would be drawn from New South Wales. If the electric smelting of these ores prove successful the coke requirement would be greatly reduced and the State Hydro-Electric Department is prepared to supply the necessary electric power for the works of very large dimensions at satisfactory rates.

In concluding these remarks, it may be stated that Burnie possesses a safe deep-water port, a genial, mild and equable climate, a rich agricultural hinterland, a happily-settled community, and in the neighbourhood there are suitable sites for attendant industries.

(Sgd.) A. McIntosh Reid,
DIRECTOR OF MINES.

21st February, 1924.

TABLE I.

Registered Number	Locality of Exposure.	Nature of Ore	Fe_2O_3	FeO	MnO	TiO_2	Cr_2O_3	CaO	MgO	SiO_2	Al_2O_3	P_2O_5	S	F
91	Section 9066M	Magnetite hematite & limonite	70.38	22.50	0.64	trace	nil	0.36	0.57	2.20	4.60	trace	nil	
93	Four chains from S.W.corner of 9066M	Magnetite	76.06	19.28	1.58	trace	nil	trace	0.10	2.00	1.22	nil	trace	
97	Section 9065M	Average grade Magnetite	72.28	22.63	0.70	trace	nil	trace	0.43	1.32	1.56	trace	nil	
98	Selected ore Section 9067M	Magnetite	95.50	1.05	1.37	trace	nil	trace	0.07	1.00	1.42	trace	trace.	
96	Grab sample from V.D.L.Co's ore-body.	Magnetite	79.60	14.18	0.50	trace	nil	0.20	0.43	1.60	3.20	trace	nil	

TABLE II.

92	Near granite contact Section 9065M	Altered lime-stone rock with Magnetite	38.20	8.00	1.00	trace	nil	22.55	0.43	24.08	5.48	trace	nil	2.39
94	Limestone Creek Hampshire	Dolomit-ised basic rock	6.69	-	-	trace	-	13.26	3.62	58.64	10.7%	-	3.75	-
95	Limestone Creek Hampshire.	Altered Limestone rock	2.46	-	-	trace	-	40.74	3.98	41.36	4.02	-	1.31	-