REPORT ON THE BLYTHE RIVER IRON DEPOSITS

1. INTRODUCTION

The inspection upon which this report is based was made at the request of the Hon. the Premier of Tasmania as a result of the apparent conflicting views of previous investigators as regards the quantity and quality of the iron ore in the deposits.

It was quickly realised that an expression of opinion as to the conclusions of previous investigators could be given without a long and detailed investigation.

As a result, therefore, only two days were devoted to field investigations, during which time the deposits were surveyed in order that a plan could be prepared. The question as to the exact quantity and quality of the ore in the deposits is quite a different matter and could only be determined after a long and detailed examination, a scheme for which will be described below.

The writer was assisted in the investigations by Mr. F. Blake, Acting Government Geologist, who carried out all the surveying and arranged the preparation of the plan.

Mr. J.D. Paterson, who holds the principal leases was present during the investigation and provided field assistants for the surveying. The tracks previously cut by Mr. Paterson's orders greatly expedited the examination of the deposits. In general, however, the conditions for examination were very unsatisfactory, as the surface is completely covered by scrub and undergrowth and all the former mine workings have fallen in and cannot be inspected.

11. LOCATION AND ACCESS

The deposits are situated on both banks of the Blythe River, about five miles inland (south) from its mouth, and some seven miles south-south-east from Burnie.

The present means of access is by motor road to within short distances of the deposits and thence by foot track.

The c onsideration of means of transport if the deposits were to be worked is at present premature.

111 LEASES

The following lease applications have been made:-

11753/M,	40 acres,	J.D. Paterson
11707/M,	80 "	R.A. Rankin
278P/M,	50 "	J.D. Paterson
11740/M,	80 "	H. Ralp
11741/M,	78 "	J.D. Paterson

The sections have been surveyed, but the leases have not yet been issued.

It is understood from information received from Mr. Paterson that all the leases except one are held on behalf of the proposed company represented by Mr. Paterson.

1V GEOLOGY

The district is portion of an elevated plateau deeply dissected by the streams. The surface of the plateau is occupied mainly by basalts representing lava flows of Tertiary age. In the vicinity of the iron deposits, the basalts range in thickness up to 200 feet. The basalts cover the older rocks (including the iron deposits).

Some portions of the plateau, the lower parts of the gorges cut by the streams, and elsewhere where the basalt has been eroded, are occupied by a series of slates, quartzites etc., probably of Lower Palaeozoic age. These rocks have been highly folded and dip at steep angles. In the vicinity of the deposits the general strike is N.N.E. and S.S.W. This series contains the iron deposits.

V ECONOMIC GEOLOGY

A. General The Blythe River iron ore deposits were those specifically investigated. The deposits outcrop prominently on both banks of the Blythe River, which has cut a gorge some 500 to 700 feet deep in the plateau. The outcrops continue more or less uninterruptedly until the overlying basalt is reached on both sides of the river. The deposit does not reappear on thes south side owing to the large extent of basalt. On the northern side, however, the iron deposit reappears after some 30 chains of basalt is passed over, and at an elevation not much below that of the general plateau level.

In general, there appears to be one main line with a length of 65 chains (assuming that it exists under the 30 chains of basalt). The general strike of this line is from N.N.E. to S.S.W. and the dip very high to the E.S.E. The Purple Cragis slightly to the east of the above line, but is probably part of it. The Eastern Crag is well off the above line and would seem to be the northern end of a parallel line. However, it is by no means impossible that it is the faulted southern portion of the main line.

The deposits as revealed by the outcrops consist of a quartzitic formation with hematite (oxide of iron) as the important mineral present. Quartzite forms a considerable portion of the deposit. Hematite is plentiful at certain portions of the deposit while white reef quartz and red quartzite (or jasper) are present in lesser amounts. The deposit has been produced by the introduction of mineralising solutions containing iron and silica into, and the replacement of, the bed of sandstone or quartzite. Where the hematite is predominent, the material has the appearance of being an iron ore, but owing to the presence of interstitial quartz, assays are necessary in order to determine accurately the grade of the ore. Other parts of the deposit are obviously too siliceous (due to quartzite, reef quartz and jasper) to form an iron ore.

The hematite is the hard dense crystalline variety and is undoubtedly of primary origin. Few, if any, secondary minerals (limonite, earthy hematite, etc.) are developed.

B Development of the Deposit In spite of the fact that the deposits were held under lease by a company for approximately 20 years, very little mining development was carried out. This was due almost entirely to the fact that no mining engineer was connected with the operations of the company. A civil engineer was in charge of field operations for some time and apparently for the remainder of the time the direction was mainly in the hands of non-technical officers. As a result, the importance of developing and sampling the deposits was not realised.

The mining works consist of five adits (or tunnels) two small open cuts, and a small number of trenches. The two open cuts and the upper or northern adit are located in the north-eastern part of the outcrop (north of the basalt). Two adits (the middle and the lower or River adit) have been driven on the outcrop on the north bank between the river and the basalt. Two short adits have been driven into the Purple Crag.

C. Economic Factors The economic value and importance of the deposit depend upon a number of factors including grade of ore, quantity of ore, conditions for mining, transport, etc., of which only the first three will be considered.

(1) Grade of Ore The grade of an iron ore depends upon its constituents the most important of which are the iron content, and the silica content. There are numerous other constituents of vital importance such as phosphorus, sulphur, etc., but as regards the Blythe River deposit only the iron and silica contents need be considered in the first place.

As already indicated, an ordinary visual inspection enables one to determine at once that considerable portions of the outcropping body would be too low in iron and too high in silica to represent useful iron ore. Of the remainder, sampling and assaying would be essential to determine the grade and which portions would be sufficiently high in iron and low in silica to enable them to be considered as iron ore.

(2) Quantity In considering the question of quantity of ore, it should be clearly understood that two different figures could be arrived at, viz:

(a) Total quantity of material in the deposit. This would be calculated from the known (and assumed) lengths, widths and depths of the deposit.

(b) Ore reserves, or in other words, the amount of ore of a suitable grade existing in the deposit. This is entirely different from the above, and could be determined only after the grade of the ore had been determined by sampling and assaying.

The estimates of Montgomery and Twelvetrees come under the heading (a) above, while that of Messrs. Boyd, Gibson and Young come under (b). In considering the estimates of Montgomery and Twelvetrees, however, their remarks should be noted.

(i) Montgomery's Estimates and Remarks (1894)

Montgomery's report was made before any developmental work was carried out. He considered the deposit to have a length of 74 chains; a width of at least 200 feet (198 feet were used in the calculations); and a depth extending down to river level, the estimates being 30,000,000 tons (assuming 3 tons of ore per cubic yard). In dealing with quality, his remarks are as follows:- "Till the mass, however, is actually cut into and tried, there are no data for estimating what proportion the pure ore bears to the entire mass, or how much lean ore would have to be quarried and rejected in obtaining each ton of first class stuff", and his conclusions are:- "I would urge ..... to have the deposit opened out by mining work far enough to allow accurate estimate to be formed of the quantity and value of the ore available, and to make sure that neither the quantity, quality, nor cost of winning has been miscalculated."

(ii) Twelvetrees Estimates and Remarks,(1901)

In his figures, Twelvetrees used average widths and heights above river level for separate lengths, and a mean specific gravity of 4.75. His total length used was 90 chains, and the widths ranged from 30 to 130 or 150 feet. His estimates were:-

tons
17,291,000/(allowing deduction of 50% for waste rock)

23,000,000 Tons (allowing deduction of 33% for waste rock)

These estimates ar subject to the reservation "An estimate of the quantities available above river level can only be made very approximately indeed. If I give figures,it must be understood that they are only intended to furnish a rough idea of the extent of the deposit."

(iii)Twelvetrees, (1919) The figures are repeated.

It will be realised from the above that Montgomery and Twelvetrees knew the type of estimate that they were giving and stressed the nature of same, together with the statement that the proportion of good ore was not known.

(iv) Estimate of Messrs. Boyd, Gibson and Young

This estimate was based upon a systematic sampling campaign of the out-cropping ore-bodies and the available underground workings. Judging by the report and plans, the work was well designed and executed and was as complete as possible. The sample cuts cannot, however, be located now though possibly they could be easily overlooked in the undergrowth. The plan seems to be inaccurate in certain respects such as the position of the Eastern Crag; but other apparent inaccuracies with regard to the positions relative to the leases may be due to the fact that the lease boundaries could not be located at the time of survey (1919). Altogether, some 192 samples were taken and assayed, and a number of composite samples were also prepared and assayed. The quantity was estimated in five blocks as follows:-

	Length	Width	Depth	Tons.
Block A (North-eastern end of outcrop)	920	60	600	2,760,000
" B (Under basalt)	1840	45	570	3,933,000
" C (On north side of river between river and basalt)	1270	45	300	1,429,000
" D (On south side of river)	700	60	200	700,000
" E (Purple Crag)	200	30	20	12,000
				8,834,000

This estimate is, however, subject to the proviso that "The bulk of this must be discarded as being far too siliceous to be of any value at the present time."

As regards the quantity of good quality ore, the investigators stated: "The only portions which can be regarded as iron ore are (a) the south-west portion of the upper or north-eastern block, and (b) the "Purple Crag". As shown by the sampling and by careful field observations the good ore (i.e., ore of the grade shown in the complete analysis at the end of the Appendix) in the north-eastern outcrop is confined to the portion lying between cuts 'B' and 'F' and even over this area it represents by far the lesser part of the deposit. Owing to its irregular occurrence, and to its more or less intimate mixture with low-grade siliceous material, it would be impossible to selectively mine any appreciable tonnage. For the same reason it is quite impossible to arrive at even an approximate estimate of the quantity available over this area. Allowing for the unavoidable admixture of a certain amount of siliceous material, it might be possible to mine ore here of an average grade of, say, 12 per cent silica. The gross quantity of even this that is available is, however, comparatively small and the cost of mining and picking it would be prohibitive. The ore in the 'Purple Crag' is of excellent quality, but the small tonnage (12,000 tons) available and its inaccessibility render it of no value at the present time."

(v) Present Investigation As a result of the present investigation, it would be possible to calculate figures as above, but it must be borne in mind that they are nothing more than geological estimates of the total quantity of material down to river level and have no relation to reserves of ore of suitable grade for marketing.

The figures are generally similar to those of Messrs. Boyd, Gibson and Young; but it is not considered advisable to include the block supposed to exist under the basalt on the north side of the river. This would reduce the figures to approximately 5,000,000 tons. In addition, a further block (that of the Eastern Crag) not previously mapped or considered, could be estimated to contain 2,000,000 tons of material. The total figures would therefore be 7,000,000 tons plus any material existing under the basalt on the north side of the river.

(3) Conditions for Mining The question of mining is influenced by a number of factors such as grade, etc., while it also affects the amount of exploitable ore.

(a) The ore consists of small patches of marketable ore in large bodies of unmarketable ore. It is obvious that a considerable amount of selective mining would have to be carried out as well as handpicking of the broken ore. These factors would considerably increase the cost per ton of marketable ore and might even raise it above that profitable for iron ore.

(b) Mining methods determine the cost per ton of ore, and as far as is possible in the iron ore industry, quarrying or open cutting is resorted to, as the cheapest means of mining. Thus the ore capable of extraction by quarrying really becomes the ore reserves.

In connection with the Blythe River deposits it has always been assumed that the ore could be taken out by quarrying to a depth corresponding to river level. It is, however, extremely doubtful if an ore-body 30 to 60 feet wide and dipping practically vertically could be quarried to depths up to 600 feet. For this reason, the above estimates would have to be reduced if intended to represent material which could be quarried. Alternatively if it were considered that the amounts stated could be quarried, the amount of overburden which would have to be removed to preserve proper working conditions would add considerably to the cost per ton of marketable ore.

V1 CONCULSIONS AND RECOMMENDATIONS

The Blythe River iron deposits include one main line with a length of 65 chains (assuming it extends under 30 chains of basalt) and a width ranging from 30 to 60 feet (or perhaps even greater in some places). It is known to occur from river level to points 700 feet higher.

Very little developmental mining work has been carried out on it and only one sampling campaign has been conducted.

The ore consists of a quartzitic formation containing hematite, reef quartz and jasper (or red quartzite). In general, the formation contains too much unreplaced quartzite to represent an iron ore capable of being mined and marketed. Innumerable lumps of what appear to be almost pure hematite occur along the outcrop, and portions of the outcrop appear to be of similar material, but much interstitial quartz is also present.

The quality or grade of the ore is certainly a doubtful point and it may be said that the proportion of high grade ore marketable in the deposit is small. The sampling campaign of Messrs. Boyd, Gibson and Young serves to indicate how little ore with silica content below 12% really occurs in the places available for sampling.

It is therefore doubtful whether the deposit contain sufficient marketable ore to render it of economic importance. The existing knowledge of the deposit, therefore, renders it inadvisable that expenditure should be made on permanent works such as railways, bins etc., and in fact it is strongly recommended that no such expenditure should be incurred. If it is proposed to work the deposit, or attempt to develop it in any way, there is one, and only one, way in which expenditure should be incurred and that is in thoroughly and systematically sampling the deposit. The same essential procedure

applies with even greater force if it is proposed that Government expenditure be made on railways.

An outline of a sampling campaign includes:-

(1) Scrubbing and burning off all undergrowth on the deposit.

(2) A survey of the deposit to locate all outcrops, mining works etc.

(3) A geological survey of the deposit (possibly combined with (2).

(4) Opening up of all collapsed adits, etc., to permit of examination and sampling.

(5) A thorough and systematic sampling campaign (samples being taken from channels cut by hammer and moil) of all outcrops, and faces exposed by underground works.

(6) Consideration of the sampling results and determination of the grade of ore and the quantity, if any, of the marketable ore.

The above sampling campaign, clearing of scrub, and opening up of the adits would involve an expenditure of at least £200. In addition there would be the cost of assaying and time spent by Departmental officers in making the survey.

It is not recommended that such a campaign should be carried out by the Government unless railway construction is contemplated and then the campaign is absolutely essential before any such expenditure on railways is contemplated, and any possible construction should depend upon the results of the sampling campaign.

If the campaign is carried out it is suggested that (1) and (4) should be carried out by the lessees and the expense borne by them, and also that the lessees should bear the expense of the field assistants necessary for (2), (3) and (5). It would be essential that (1) and (4) should be completed before any departmental officer visits the field.

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13/1/37.