

REPORT ON EXAMINATION OF IRON ORE DEPOSITS IN TASMANIA

I desire to report that in company with Mr. F. Blake, Acting Government Geologist of Tasmania, I left Hobart on 7/2/39 and reach Zeehan at midday on 9/2/39. At Zeehan we examined almost the whole extent of the known iron ore deposits in company with Messrs. W. and E. Thomas who were associated with the early operations to test these deposits, and who carried out the recent clearing operations to facilitate inspection.

Of the sixteen adits excavated for Hoskins Bros., fifteen have now been examined superficially by Mr. Blake and me. Most of these adits are partially or completely collapsed and no inspection can be made. We have examined some of these which are still open and have found that there is an extraordinary difference in texture and quality of ore in the adits and in the surface outcrops respectively. In those cases in regard to which we can speak with confidence, it appears that there has been a surface purification, enrichment and solidification which gives a false and exaggerated idea of the importance of the deposits.

Since this factor may be universal and may modify profoundly the conclusions arrived at in connection with the ultimate availability of the deposits, we propose to open up and repair three of the collapsed adits which we consider will provide reasonably conclusive evidence as to the nature of the ore bodies in depth. One of these adits intersects the (northern) Tenth Legion deposit, the other two are situated in the eastern arc of the north-south ore zone. The evidence in regard to the western arc of the north-south zone, which is situated nearest to the granite contact, we consider sufficiently conclusive without further underground investigation. The bodies in this zone are neither large enough, continuous enough, nor rich enough to warrant inclusion amongst the major iron ore reserves of Australia.

The Minister has already approved of the expenditure of £250, in repairing adits in this area and the work will be undertaken as soon as Mr. Blake can complete the arrangements.

On 10/2/39 we proceeded to Waratah accompanied by Mr. Edgar Thomas who worked on the Rio Tinto area when his father was carrying our investigations for Hoskins Bros. We went to Rio Tinto on 11th February and spent 12th and 13th examining the iron deposits there. The evidence in this locality is not nearly so conclusive and clearly defined as is that at Zeehan. The terrain is difficult in the extreme as the plateau is intersected in all directions by steep sided gorges some 800 feet in depth. The slopes are covered by dense "West Coast Scrub" than which no vegetation could be denser. The original difficulties have been increased by the prolific growth of blackberries. Even though favoured by phenomenally fine weather it was found impossible to attempt anything approaching a detailed examination. The best that could be done was a fairly extensive traverse of the lines which have been "cleared" through the scrub since the investigations were undertaken by the Commonwealth Government. But for this partial clearing practically nothing could have been done. It seems desirable to stress this point since there has been some adverse criticism of the expenditure incurred for this purpose. Certainly at Rio Tinto some energy

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has been wasted in the attempt to clear a large area completely. This was done by the working party in error. The instructions given by Mr. Blake were quite definite namely, that lanes of access, only, were to be cleared. The leader of the party, however, who had recently cleared the Blythe River deposit, where (as will be shown below) complete clearing was essential, misunderstood the orders.

The deposits were reported on in 1919 by Mr. McIntosh Reid and the results published in Mineral Resources No. 6 of the Tasmanian Geological Survey. He concluded that, on certain assumptions set forth in his report, the deposits of high-grade magnetite amounted in the aggregate to approximately 20 million tons.

In casting doubt on the accuracy of this estimate no reflection is made upon the previous investigations, which were carried out under conditions even less favourable than those which exist today. It is remarkable, not that the early reports should be lacking in some respects, but that so much valuable observations should have been carried out under such extremely difficult conditions.

When the earlier investigations were made there existed only very shallow excavations in the form of costeans and pits. All the samples analysed were obtained within a very few feet of the surface, and chiefly from the crests of the ridges (portions of the peneplain surface) where the oxidising - and therefore purifying - effects of meteoric water were most pronounced. In such conditions the complete removal of sulphur derived from pyrites is easily understood, and the high degree of purity of the iron oxide in Reid's analyses is explained.

Subsequent excavations of shafts and tunnels has revealed the presence of large proportions of pyrites at shallow depths. We are of the opinion that the presence of numerous cavities, large and small, in the surface ore is to be explained as due to removal by oxidation and solution of original pyrites. We have been able to trace stages in this process in material brought to light by more recent excavations.

Reid believed that there existed large bodies of pure magnetite and hematite free from pyrites, and other distinct bodies composed of oxides and sulphides. The latter occurred chiefly in the deep valleys. We consider that this distinction is due not to primary differences of type, but to the physiographic conditions of exposure in the two cases. Deposits at or near peneplain level have been oxidised (desulphurised) while those very recently exposed (geologically speaking) in the bottoms of exceedingly juvenile valleys have not been oxidised appreciably.

Mr. Thomas, Senior, informed us that he had observed pyrites even near the surface in many localities. We have not been able to confirm this observation.

Reid claimed relatively enormous longitudinal continuity for some of the bodies of ore described by him. We can neither affirm nor deny this from our observations. In view of the difficulty of the terrain, the density of the undergrowth, the wide distribution of weathered ore material and the marked discontinuity of solid outcrops (commented on by Reid) we feel extreme doubt concerning the continuity of the bodies. Our observations lead us to the belief that it is probable that there are numerous

rather small isolated lenses of ore, arranged en echelon along a broad zone of crushed and mineralised formation, rather than one long and continuous band of ore. Such longitudinal discontinuity would strongly favour similar discontinuity in depth.

While, then, there are unquestionably very numerous lenses of high-grade magnetite ore along the ridges, aggregating to very considerable tonnages, we are convinced that, until a great deal more underground investigation has been carried out, it cannot be maintained that either the quality or the quantity of ore justifies the claim that these deposits are of major dimensions.

Since the ore is dominantly magnetite (relatively refractory) and since the situation of the deposits in regard to working and transport facilities is far from favourable, we do not feel justified in recommending that heavy expenditure should be incurred in further investigations at this stage. Surface survey alone would be slow and would involve much expense in the clearing of tracks through the scrub. Its results could not be in any way conclusive owing to the factors of uncertainty mentioned above.

Incidentally we desire to emphasise strongly the futility and wastefulness of extensive trenching and costeaning of deposits of this character in such country. We have examined the very extensive trenches cut by previous prospectors, and have noted that, though very large sums of money must have been expended, the positive information brought to light has been negligible. In practically every instance the trenches have begun and ended in detrital material, shed from outcrops at a higher level. In the few instances, in which apparently solid outcrops have been encountered, work has ceased with the uncovering of the "cap" of the deposit. As pointed out above such superficial material is likely to be quite unrepresentative of the material at depth.

Most of the shallow shafts sunk have revealed nothing but detrital material. One, sunk on a solid outcrop encountered pyritic material at a depth of about 20 feet.

While we located many of the older workings there were some, particularly on the northern side of the Savage River, which could not be found in spite of assiduous search. They have, apparently, been completely overgrown with vegetation. Some of the adits have collapsed and are inaccessible, but the excavated materials on the dumps reveal the class of formation encountered and show the abundance of sulphides. Other adits were examined throughout and the existence of large amounts pyrites in situ was substantiated.

We therefore conclude in relation to the Rio Tinto deposits:-

- i Tonnages of ore of the order of 20 million tons are "not proven".
- ii There are grave doubts as to the continuity of the major ore bodies assumed in previous reports.

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- iii There is very strong evidence that the freedom from sulphur brought out in published analyses is due to surface oxidation and purification of the ore and and that the bulk of the material is likely to be strongly pyritous.
 - iv The nature of the ore and its probable quantity and quality render it unattractive for blast furnace smelting on a large scale according to existing world practice.
 - v The geographic situation of the deposit would permit of extraction of the ore commercially only if its nature, quality and quantity were all highly favourable.
 - vi Further investigation of the deposits to be of any real value must be drastic and conclusive, and, therefore, very expensive. We do not consider such expense warranted, and we recommend that no further investigation of these deposits be undertaken at present.

Tuesday, 13th February, was taken up in returning to Waratah which was not reached till 11 p.m. owing to breakdown of car.

On 14th we proceeded to Burnie and spent the afternoon examining a small deposit near Natone, mostly situated on Mr. Rutherford's farm, but extending into adjoining properties.

This deposit is of some importance as somewhat extravagant claims have been made of its extent and richness. It is understood that a company of which Mr. Linnell-Cook is the manager, proposes to work this deposit for iron ore and to treat the material locally by electrical methods of smelting to produce steel directly from the ore for the construction of steel pipes.

As has been pointed out previously, such direct methods, though used somewhat extensively on a small scale, are regarded by experts as still in the experimental stage. Nowhere are they employed for the manufacture of steel in a large way and their output is insignificant in comparison with that of blast furnaces of even modest dimensions.

It is believed that numerous small units of this type are employed in Scandinavian countries for the production of special steels, and that the founder of the company which proposes to operate in Northern Tasmania has visited Norway and Sweden and obtained first hand information in connection with plant and operations.

Since the proposed industry contemplates the local smelting of iron ores, employing electrical power developed by the Government of Tasmania, and does not contemplate the exportation of crude ore from Australia, its operations may be viewed with satisfaction.

We consider, however, that we must sound a note of warning against undue optimism at this stage, and notably against exaggeration in the calculation of ore reserves. We believe that a claim has been advanced that there exists a continuous body of iron ore extending from a point north of the Blythe River, across that stream, through the Natone and Highclere deposits and on to Hampshire on the Emu Bay Railway.

Jointly and severally we are convinced that this is not so.

It is highly probable that there exists a continuous zone of disturbance, almost certainly a zone of crushing and shearing, along the line mentioned. This zone is marked by extensive mineralisation but silicification is, unfortunately, much more profound and extensive than is hematization. Bodies and lenses of high grade hematite do occur at intervals but the great bulk of the hematized material is very highly siliceous and unworthy of being classed as iron ore. It is extremely important to realise this fact, since geophysical methods, in their stage of development, are incapable of distinguishing between pure and impure iron ore beneath the earth's surface.

Continuity of outcrops of the mineralised zone is interrupted by residual cappings of Tertiary basalt which once covered the whole of the plateau. While it is not unreasonable to suppose that the shear zone continues beneath the basalt, the analogy of the visible outcrops shows clearly that only minor portions of it can be assumed to consist of workable iron ore.

At "Rutherford's" there exist several lenses of massive hematite, some of it apparently of high grade, but much of it highly siliceous. The dimensions of these lenses cannot be determined accurately owing to the wide distribution of detrital material derived from the bodies themselves. Here, as always in the case of massive hematite bodies, the immunity from chemical and mechanical erosion exhibited by the mineral greatly exaggerates its apparent extent and bulk.

A small amount of shallow trenching has been carried out and a few "pot holes", none worthy of the name of shafts, have been sunk. As is too often the case in operations of this character, work has ceased at the point where it might begin to be instructive, namely with the finding of outcrops of iron ore apparently in situ.

It may be pointed out parenthetically that this faulty method is a legacy of familiarity with the technique of search for ordinary metalliferous reefs, particularly for those containing gold, for which purposes it is useful and legitimate. In such cases the location of the ore channel is the fundamental aim of the search. In such metalliferous reefs the valuable constituent usually constitutes a very small percentage of the lode material - in the case of gold, only, at most, a few ounces to the ton.

Iron deposits are in an entirely different category. In the first place the size and continuity of the deposit are of great importance, and in the second the nature and quality of the ore must be both satisfactory and uniform. These characteristics can be determined only by extensive sub-surface exploration. As pointed out ad nauseam elsewhere, drilling is unsatisfactory to secure

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this information and only direct access by means of tunnels is at all conclusive.

At "Rutherford's" the most pronounced evidence of hematite bodies extend longitudinally (about N.N.E. - S.S.W.) over a distance of only some 10 to 15 chains. Extensions both north and south are indicated by somewhat thinly scattered detrital material, but the important outcrops appear to form the crest of only one hill.

The whole of this axis is not composed of ore - very far from it. It is questionable whether any one of the lenses has a width of more than 20 to 25 feet at most. As noted above the number and dimensions of the ore lenses cannot be stated without much more properly planned and executed prospecting work which should be completed before any estimates of tonnages available can be accepted as even reasonable.

We are informed that a geophysical survey of the area has been carried out by a commercial geophysical organisation and that large tonnages have been reported as a result of this survey. For the reasons given above we are unable to place any reliance upon information obtained in this way unless and until it is supported by objective proof of the presence of ore of workable quality in the situations predicated by the geophysical measurements.

Two shallow bores were put down by private enterprise utilising the staff and equipment of the Mines Department. Neither bore, we understand, attained a depth of as much as 70 feet, and we are informed that the quantity of high grade ore intersected was very small.

While, therefore, we are desirous of encouraging so laudable an enterprise as the local electric smelting of Tasmanian iron ore, we are compelled to report that we can find no evidence of the existence of any ore body of even moderate dimensions, and that the existence of a major deposit of iron ore at this point is definitely disproved.

On 15th February we revisited and inspected the Blythe Rive locality concerning which so many conflicting reports have been made, and which was visited by us during 1938 (and several times by Mr. Blake.)

As explained previously, we were convinced that much of the existing confusion and contradiction was due to the fact that the rock and mineral outcrops were obscured and hidden by dense vegetation, preventing adequate and comprehensive survey of the structure. For this reason, with approval of the Minister, the whole area was cleared of forest and undergrowth. Though this procedure was somewhat costly we consider that the result has justified the expenditure incurred. We were able to obtain comprehensive views of the structure as a whole and to pick out and inspect closely all outcrops even suggestive of providing ore in appreciable quantities.

Owing to the fact that the structure is intersected almost at right angles by the steep-sided gorge (here some 750 feet deep) of the Blythe River, the outcrops on either side of the river are thus revealed completely, in elevation, from the other side, and an ensemble view is secured which is rarely available to the geological surveyor.

Though the rapid growth of ferns and "suckers" will soon reclothe the slopes it has not yet reached the stage of obscuring the essential geological features.

On this occasion, as noted above, every conspicuous outcrop on both sides of the gorge was visited and examined. The result was entirely confirmatory of the most pessimistic views previously expressed. The so-called Blythe River iron ore deposit does not exist.

There is abundant evidence that the structure, as a whole, is a wide shear zone (as described above in connection with "Rutherford's") much silicified and to a less extent impregnated with hematite. Movement involving powerful brecciation occurred both before and after the deposition of the hematite; since shattered fragments of the originally hematized schist breccia build up a secondary coarse breccia. This is particularly well illustrated in the "Purple Crag" on the south side of the river.

The shear zone dips steeply in a general south-easterly direction.

At no point have we been able to find any considerable mass of hematite sufficiently free from silica to be classed as an iron ore. There are small disconnected lenses of pure hematite scattered through the mass of crushed and sheared schists, but none of these is of sufficient dimensions to be mined individually and they are too sparsely distributed to be mined collectively.

Even "The Purple Crag" described as the best individual deposit in the area, proves to be exceedingly disappointing on close investigation. While some thousands of tons of ore might be secured from it by selective mining, the large amount of siliceous material scattered through it would preclude bulk mining.

The situation and form of the body give no promise or even suggestion of sub-surface extension. The mass appears to be an exceptional and isolated "knot" of hematite, completely surrounded by country rock. A small tunnel driven underneath it indicates that this mass is simply lying on the surface of the rock slope.

We are unable to enter the adit just above river level on the north side, but the previous reports by Boyd, Gibson, Young and Nye are completely explicit in regard to the evidence there.

We are regretfully forced to report that:-

- i We can find no justification for the belief that a major iron ore deposit exists in this locality
- ii The cost of clearing the scrub from the area has been fully justified. In no other way could we have obtained such complete access to the deposit as would enable us to arrive at the definite result stated above.
- iii If it is deemed desirable to carry out a detailed survey of the area, this can be undertaken by the Tasmanian Geological Survey. To make use of the facilities for access provided by the clearing of the vegetation such survey must be undertaken

without delay - if at all. We are, however, so completely convinced of the economic worthlessness of the deposit that we recommend that no such survey be undertaken.

Mr. Blake has read the manuscript of this report so far as the Zeehan and Rio Tinto deposits are concerned. He has not seen those portions referring to "Rutherford's" and the Blythe River, but geological details, conclusions and recommendations were carefully discussed with him before I left Tasmania.

(Sgd. W.G. WOOLNOUGH.

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