REPORT ON A DEPOSIT OF IRON ORE AT THE BLYTHE RIVER.

Geological Surveyor's Office, Launceston, 5th March, 1894.

SIR,

I HAVE the honor to report upon a deposit of hematite iron ore on land held under mineral lease from the Crown by Mr. R. Quiggin on the Blythe River, some seven miles from its mouth. On the 16th of January last I made a superficial examination of the deposit, but, as it is still quite in a state of nature, and in no way opened up by cuttings or mining works of any sort, I was not able to make such a minute study of it as its importance undoubtedly deserves. Before it can be properly examined, and its extent and value accurately estimated, a considerable amount of time, money, and labour will require to be expended in clearing, trenching, and sinking upon it. From what is even now visible, however, it is quite clear that the ore is present in enormous quantity, and in a position affording splendid facilities for cheap mining, and there is every inducement to open quarries upon it and try it in a practical manner, provided it can be shown that there is any reasonable probability that iron-smelting can be made to pay in the Australian Colonies under existing conditions of the labour market, prices of fuel, and demand for the metal. As to this I shall have something to say later on, but first it is necessary to describe the mining property itself. The accompanying map, copied with slight alterations from one by Mr. Peart, authorised surveyor, kindly lent to me by Mr. Norton-Smith, of Burnie, will illustrate the description.

The iron deposit may be reached by either of two routes from the main road connecting Ulverstone and Burnie, the easier one being along the road through the Parish of Stowport, lying between the Blythe River and the Heybridge Rivulet to Ellis's, O'Keefe's, and Etchell's selections. The ore is met with on O'Keefe's western section, and on the adjacent Crown land, on which Mr. R. Quiggin holds under mineral lease the following sections :—1061-91M, of 40 acres; 1009-91M, of 73 acres; 851-91M, of 78 acres; and 856-91M, of 80 acres. As shown on the map, the outcrop of the deposit traverses the first three of these sections and the western part of O'Keefe's purchased block. The second route to the mine is along a track which runs up the eastern side of the Blythe River to it, but this is now in bad order, and not practicable for horses. Going over these two routes, the structure of the country is fairly visible, the sections afforded by the deep gorge of the Blythe River, and along the coast line, showing it very plainly. The main country rock is of sedimentary origin, consisting of sandstones, slates, and occasionally limestones of probably Silurian age, or even older. No fossils were seen during my visit, and I could not hear of any having ever been got in this vicinity, so there were no data for determining the age of the formation. The strata dip at high angles, and are very much metamorphosed, at times approaching schists and quartzites. Their general strike is north-east and south-west, conforming closely in this to the strike of the iron ore deposit. These older strata are seen all the way up the Blythe River gorge to the mine. The valley of this stream is a deep one, the bottom being 500 feet below the agricultural selections on each side of it at the place where the hematite crosses. This farming land is fairly flat on the whole, though a good deal undulating, and is composed of basalt of Tertiary age which covers the older rocks first mentioned. It is found on both sides of the Blythe River valley, and decomposes to a fertile agricultural soil.

The deposit of iron ore has been cut through by the Blythe River, and is found on each side of its valley rising up the slopes until it disappears under the basaltic capping. The outcrop is about five chains in width, and even allowing for loose stones from it gravitating down hill and making it appear wider than it really is, I do not think that there can be less than about 200 feet in width of ore on an average; along its length it has been traced and is easily visible for 74 chains, or close on a mile. The ore crops out in large lumps and the surface soil is full of it, and at several points, some of which are marked on the map, it stands up in large rocks and cliffs; these afford the best sections of the ore-body yet available, and a careful inspection of them shows it to be a massive hematite with a large proportion of very pure high-grade ore. In some parts there is a good deal of quartz mixed with the hematite, sometimes in strings and veins and sometimes in angular fragments; I also noticed a good many pieces of jasper and of siliceous hematite. The north end of the ore mass seemed rather more siliceous and impure than the parts close to the river. The whole deposit is therefore by no means a pure high-grade hematite, but there can be no doubt that very large quantities of very pure ore with little silica could be obtained without much picking. 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. This is a factor of the greatest importance in calculating the cost of mining the hematite, and will require to be attentively studied during the progress of preliminary exploratory work. In the bed of the Blythe River there is a large amount of very good ore, representing no doubt the hardest portions of the stuff which has fallen into it, the softer and more friable matter being washed away by the water. Waterworn ore is found in the bed of the stream for some distance down, and nearly a mile below the mine I noticed rounded boulders of it in an alluvial terrace, probably quite 20 feet above the water's level. It would probably be worth while ascertaining if the bed of the stream could not be worked profitably for the fine hard ore which has been concentrated in it by natural sluicing operations. As it was quite impossible for me, in the undeveloped state of the mine, to obtain a sample of the ore which would at all fairly represent its average bulk value, and as such a sample would indeed be of no particular use, inasmuch as in actual working a lot of lean ore would be necessarily rejected, I only took a few samples of the best looking boulders in the river for analysis. They may be looked upon as fairly representing the best ore, but from inspection I should judge that many thousands of tons of equally good stuff could be readily obtained. What the average yield of such first-class ore from the bulk of the deposit would be is, as already remarked, only to be ascertained after it has been opened out by trenches and cuttings. The samples taken were forwarded to Mr. W. F. Ward, Government Analyst in Hobart, with instructions to have them carefully examined for all impurities likely to interfere with the quality of the iron to be made from the ore. He reports the analysis as follows:—

"Iron peroxide (= iron 66·4)	95·2 per cent.
Silica	4·8 "
Phosphoric Acid	Traces.

This ore is of excellent quality, being practically free from all impurities with the exception of the silica. It resembles the well-known Cumberland Red Hematite, so long used for the production of steel by the Bessemer process."

According to this analysis, the Blythe River hematite is one of the finest and purest in the world, ranking with the famous Spanish, Algerian, and Cuban ores, which are now exported in very large quantities to the United Kingdom, United States, France, and Germany, for the manufacture of Bessemer steel. The deposit must be one of the largest also, containing many millions of tons. The data for calculating its size are very insufficient, but, taking them such as they are, a rough calculation may be made which will serve to give some idea of it. On the south side of the river the ore is seen for a horizontal distance of about 8½ chains, and rises to a height of 280 feet above the stream: on the north side it rises to 500 feet above the river, in about 50 chains horizontal distance, and then falls a little, say, to 400 feet, for another 16 chains. Taking the width of the ore-body at 66 yards, these measurements give the cubic contents of the deposit under the visible outcrop down to the level of the Blythe River as slightly over 10,000,000 cubic yards, or, at 3 tons to the cubic yard, 30,000,000 tons. It is not to be supposed that the ore terminates where the outcrop disappears under the superficial basalt, or that it only goes down to the level of the Blythe River, while the width also is probably underestimated, so that the deposit is clearly of enormous extent.

It is, too, most favourably situated for economical working, the steep sides of the river gorge giving exceptional opportunities for mining by open quarrying. Working faces could be opened at different levels on both sides of the river, so that an army of men could be at work at one time quarrying the ore in steps, and it could be lowered to the river by self-acting tramways, and in some places even by shoots, by gravitation, at very small expense. The cost of mining ought to be very low.

The Blythe River is at all times a considerable stream, and would be able to supply power for working air-compressors, electric-lighting appliances, and concentrating machinery. The latter would sooner or later be required as the best way of getting rid of the piles of second-class ore that would rapidly accumulate in working. The possession of this good water-power would be a large factor in the economical working of the mine.

The gorge of the Blythe is pretty steep and rough, but I do not think any serious difficulty would be found in making a railway down it from the mine, a distance of between six and seven miles. The present track on the eastern side of the river is six and a half miles from the mine to the main road and to the surveyed line of the Ulverstone-to-Burnie Railway. It seems highly probable, however, that the western side of the river would be the better one for the line to the mine. It has also been proposed to take a railway direct to Emu Bay, but I understand there are serious difficulties in the way of doing so. Going down the Blythe River and then along the Ulverstone-Burnie Railway the ore would have to be carried about twelve miles to reach the Emu Bay Breakwater for shipment, and the grades would be easy ones, so the item of carriage of ore to port of shipment ought to cost but little.

This iron mine, therefore, possesses the advantages of enormous quantities of ore easily mined, of great purity of the mineral, and of proximity to a deep-water port, also of ample water-power; and if any mine of iron will pay in the Australian Colonies this one should.

I have not been able satisfactorily to convince myself whether this deposit is a true lode or an ore-bed, but incline to the latter opinion. The strike of the ore-body coincides as nearly as possible with that of the enclosing country rocks, and in one or two places I thought traces of stratification in the ore itself could be detected. The purity of the mineral, too, rather favours the ore-bed explanation. On the other hand, the occasional strings, veins, and angular enclosures of quartz rather point to its being a lode. Similar strings and veins, however, occur in the surrounding country rock, and it seems possible enough that those in the ore are similarly formed by infiltration of silica into cracks and crevices of its mass long after it was formed. It seems most probable that the ore-bed was originally a mass of brown iron ore deposited along with the sandstone and slate strata when the latter were laid down as horizontal layers; in the course of time the strata have become tilted on edge, and the brown iron ore has become changed to the red hematite. From a mining point of view it matters little whether the ore is in a lode or in a nearly vertically-dipping bed, as the method of working is the same in either case; but if it could be proved to be a bed or sedimentary deposit greater confidence would be felt as to its remaining of fairly uniform quality over long distances in length and depth. When some mining work has been done it will probably be easy to definitely settle the question of the classification of this deposit.

It is not the only one in this part of the country, for not many miles away, near the Penguin River, there is another large iron ore deposit, which is described as quite similar to the Blythe River one, but which I have not myself seen, and possibly many others lie concealed beneath the superficial basaltic covering.

There can be little doubt when the time comes for making iron in the Australian colonies these iron mines will be of immense value to their owners and to the country. The important question now to be considered is, can they be profitably worked at the present time? It should be the work of a specialist in the manufacture of iron, thoroughly conversant with the European and Colonial iron markets, and with the conditions under which the metal is made elsewhere and would have to be made here, to give an answer to this; and only such a one can speak with authority on the subject. Having only a general knowledge of the problem I cannot claim any such authority, and any opinion now expressed by me would require to be verified by a specialist before being acted upon; but I have endeavoured to gather together some reliable facts and figures which may serve to throw light upon the question. By the kind assistance of the Government Statistician I have been able to obtain returns from all the Australian colonies except Queensland and Western Australia and from New Zealand, of the value of iron and iron goods imported into them, which will give some idea of the demand for iron that already exists. As the classification adopted by the various Colonies is not uniform, I have not found it possible to combine all the returns in one table, and therefore present them as revised for the five years ending with 1892.

Imports of Iron and Steel into Tasmania.

	1888.	1889.	1890.	1891.	1892.	Total.
	£	£	£	£	£	£
* Manufactured goods of Iron and Steel	164,621	171,240	190,537	220,624	163,016	910,038
Galvanised Iron	...	2855	4400	4879	3932	16,066
Galvanised and Corrugated Iron	...	...	...	...	1437	1437
Iron—Rod, Bar, Hoop, &c.	21,935	17,966	19,482	19,074	14,015	92,472
Iron pipes	...	7258	11,488	4741	12,865	36,352
Railway Material	25,142	22,051	59,038	35,537	6211	147,979
Steel, unmanufactured	...	1335	1964	2581	1902	7782
Tin-plates, unmanufactured	...	3745	4215	5651	4435	18,046
Total £	211,698	226,450	291,124	293,087	207,813	1,230,172

* Including cutlery, hardware, and goods of all sorts mainly composed of iron and steel.

Imports of Iron and Steel into South Australia.

	1888.	1889.	1890.	1891.	1892.	Total.
	£	£	£	£	£	£
Steel and Iron Rails	814	615	4459	36,725	35,381	77,994
Rod and Bar Iron	32,178	23,948	55,607	43,421	42,179	197,333
Pig Iron	14,548	23,378	22,246	18,482	14,436	93,090
Manufactured Iron Goods*	41,691	56,950	95,448	88,661	76,241	358,991
Total £	89,231	104,891	177,760	187,289	168,237	727,408

* Including drain pipes, columns and girders, pipes and tubes, fencing, plate and sheet, hoop, fencing wire.

Imports of Iron and Steel into New Zealand.

	1888.	1889.	1890.	1891.	1892.	Total.
	£	£	£	£	£	£
Steel and Iron Rails*	22,844	35,367	50,319	24,810	17,072	150,412
Rod and Bar Iron	33,390	39,225	36,066	41,195	62,694	212,570
Pig Iron	9556	13,684	16,728	15,531	13,177	68,676
Manufactured Iron Goods, Pipes, &c. †	215,315	346,723	319,303	302,996	389,635	1,573,972
Total £	281,105	434,999	422,416	384,532	482,578	2,005,630

* Rails only, exclusive of railway bolts and fastenings.
† Exclusive of cutlery, hardware, hollowware, and ironmongery, nails, railway plant, implements, tools, and machinery.

Imports of Iron and Steel into New South Wales.

	1888.	1889.	1890.	1891.	1892.	Total.
	£	£	£	£	£	£
Railway Material *	87,033	98,257	297,666	826,256	346,755	1,655,967
Rod and Bar Iron (including plate and sheet)	125,393	141,297	181,576	214,009	150,872	813,147
Pig Iron	30,690	29,454	25,124	35,214	25,772	146,254
Manufactured Iron Goods (including Drain Pipes)	1,794,771	2,155,227	2,363,998	2,924,982	2,259,516	11,498,494
Total £	2,037,887	2,424,235	2,868,364	4,000,461	2,782,915	14,113,862

* The value of rails only cannot be stated.

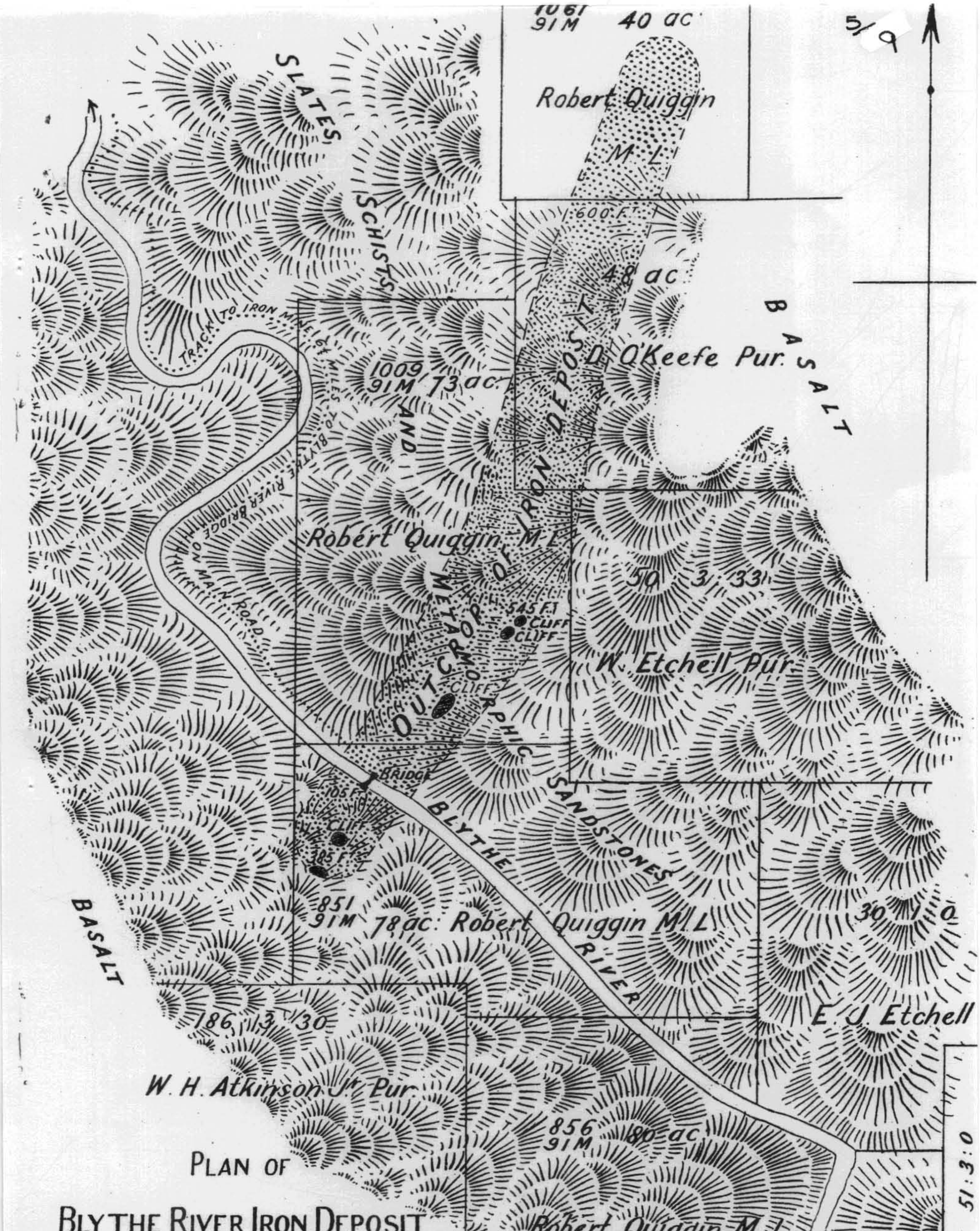
Imports of Iron and Steel into Victoria.

	1888.	1889.	1890.	1891.	1892.	Total.
	£	£	£	£	£	£
Steel and Iron Rails	237,334	436,184	162,548	10,589	4192	850,847
Rod and Bar Iron	122,548	197,870	159,572	105,135	64,415	649,540
Pig Iron	89,174	99,895	83,950	73,532	31,015	377,566
Steel	43,854	53,179	53,740	35,446	25,433	214,652
Manufactured Iron Goods, Pipes, &c.*	1,558,170	1,747,073	1,572,217	1,514,088	1,000,887	7,392,435
Total £	2,051,080	2,534,201	2,032,027	1,738,790	1,125,942	9,482,040

* Including Steel Cordage.

As will be seen, the item "Manufactured Iron Goods" in the above tables includes a great deal more in the Returns of some of the Colonies than in those of others. Taking the grand totals for the five years as they stand, however, their sum amounts to £27,559,112, and if we include Queensland und Western Australia, whose Returns I have not been able to get in time for this Report, we may safely estimate the grand total for all the Colonies at £30,000,000, or at the rate of £6,000,000 worth of iron goods per annum. To get greater accuracy it would be necessary to deduct the exports of iron from each Colony to ascertain the amount used; but against this we may place the large value of iron goods of all sorts not shown in the tables, and probably this would quite compensate for the exports. It is therefore clear that a very considerable market exists, which would be able to absorb the produce of a fairly large smelting-works.

Should iron-smelting be begun in Australia it is probable that for some years the production would be confined to pig iron, iron and steel rails, iron and steel rods, bars, girders, columns, and other simple shapes, and foundry material, though in course of time no doubt it would be found possible to compete with Europe in manufactured goods of all sorts. Turning again to the tables, it is seen that the imports of pig iron, rod and bar iron, unmanufactured steel, and steel and iron rails and railway material amount to a grand total of £5,753,281, which may, however, include locomotive engines in the cases of New South Wales and Tasmania. However, counting in Queensland and Western Australia, it should not be far from correct to assume the colonial consumption of the above sorts of iron as averaging about £1,000,000 in value annually for the period quoted. It is not to be supposed that one smelting establishment would be able to supply all the different brands of iron required for manufacturing purposes, or could beat all foreign competitors so thoroughly out of the field as to be able to hold a monopoly of it; still the figures show a market large enough to encourage us to believe that our own iron smelters would not have any surplus metal requiring to be exported for sale. It is not probable that for many years to come Australia will be able to compete with Europe and America in the open markets of the world, but if we can hold our own within our own domain, and consume all the iron we can produce, the iron manufacturing industry would soon need no special fostering.


1061
91M
40 ac
Robert Quiggin
M. L
600 F.T
48 ac
D. O'Keefe Pur.
BASALT
SLATES,
SCHISTS
AND
METAMORPHIC
SANDSTONES
TRACK TO IRON MINE 6½ MILES TO BLYTHE RIVER BRIDGE ON MAIN ROAD
1009
91M
73 ac.
OUTCROP OF IRON DEPOSIT
Robert Quiggin M.L
545 F.T
CLIFF
CLIFF
CLIFF
50 3 33
W. Etchell Pur.
BRIDGE
105 F.T
CLIFF
185 F.T
BLYTHE
RIVER
851
91M
78 ac. Robert Quiggin M.L
30 1 0
BASALT
186 3 30
E. J. Etchell
W. H. Atkinson Jr. Pur.
856
91M
80 ac
51:3:0
PLAN OF
BLYTHE RIVER IRON DEPOSIT
Robert Quiggin M.L
5 cm
66:2:10
W. Bramich Pur.
Crown Land
A. Montgomery
Geological Surveyor
5th March 1894

Now let us try to arrive at some estimate of what it would cost to make iron locally. To get at this we must first see what it costs elsewhere. I am indebted to "The Mineral Industry, 1892," by Mr. R. P. Rothwell, for most of the facts and figures on this head now to be quoted.

From tables prepared by the U.S. Labour Bureau, under the Hon. Carroll D. Wright, Commissioner, covering the period between 1887 and 1890, it appears that the total cost of one ton of run-of-furnace pig iron, as reported by 26 establishments in the Northern District of the United States, averaged \$13·94 (=£2 18*s.* 1*d.*), and in 24 establishments in the Southern District, \$10·75 (=£2 4*s.* 9½*d.*): one establishment on the Continent of Europe gave the average cost per ton as \$11·03 (=£2 5*s.* 11½*d.*). The details of cost at the above 50 U.S. establishments are of interest as showing the main items of expense and their relative importance, and are therefore quoted, the average costs being taken :—

	Northern.	Southern.
Ore	\$6·96	\$3·47
Cinder, scrap, &c.	·58	·01
Limestone	·50	·47
Coke	3·33	4·46
Coal	·37	·00
Total minerals	\$11·74	8·41
Labour	1·47	1·53
Officials and clerks	·18	·16
Supplies and repairs	·51	·61
Taxes	·04	·04
Grand Total	\$13·94	\$10·75

In the same tables the cost of charcoal iron is given from seven establishments in the Northern States, and from one in the Southern, ranging in the former from \$14·45 to \$25·24 (average \$19·45) per ton, and in the latter being given as \$10·27. The writer of the article on Iron in "The Mineral Industry," however, says:—"It is not at all likely that the average cost of hot-blast charcoal iron anywhere in the country is below \$14."

The average cost per ton of Gray forge iron in the Northern District of the United States is given as \$13·50, in Great Britain as \$8·03, and on the Continent of Europe as \$9·06. No. 1 foundry iron in the Northern United States is given as costing on an average \$13·86 a ton, and on the Continent of Europe \$7·74, excluding taxes. Spiegeleisen on the Continent cost \$15·07, only one establishment's figures being quoted however. Basic or Thomas iron on the Continent cost \$9·63, and in Great Britain \$10·89 a ton. The average cost of Bessemer iron in the Northern United States was \$15·37, in Great Britain, \$10·33, and on the Continent of Europe, \$11·74.

The average figures for Bessemer iron and Gray forge iron respectively made in Great Britain, quoted in Mr. Wright's Report, are in detail made up as follows :—

	Bessemer iron.	Gray forge iron.
Cost of Ore per ton, of pig	\$6·09	\$3·63
" Cinder and Scrap	0·23	0·10
" Limestone	0·20	0·32
" Coke	2·64	2·74
" Coal*	·0075	·02
" Labour	·6625	·67
" Officials, clerks, &c.	·055	·04
" Supplied repairs	·43	·33
" Taxes	·015	·02
" Items not detailed	...	·06
Total cost of Pig	\$10·33	\$7·93
Number of establishments reporting	4	3
Number of furnaces	4	6
Average output per day per furnace	76 tons	78 tons
Tons of Ore used per ton of pig	1·8	2·45
" Cinder and Scrap	·07	·22
" Limestone	·345	·45
" Coke	1·175	1·08
" Coal	·0025	·007
Average cost of ore per ton	\$3·39	\$1·48
" " Cinder and Scrap per ton	0·32	0·45
" " Limestone per ton	0·58	0·71
" " Coke per ton	2·25	2·53
" " Coal per ton	3·00	3·00

* In one Bessemer and two Gray forge establishments about one ton of coal is used along with every hundred tons of coke.

It is not explained why the coal should cost more than the coke per ton, but it is probably not the same as that from which the coke is made, and may perhaps be anthracite brought from some distance. The smelting, however, is substantially all done with coke.

It is seen from the above that the most important items of cost of making Bessemer iron, which is what we have at present to consider, as the Blythe River iron mine yields an excellent Bessemer ore, are the cost of the ore and the cost of the coke used for smelting it, these two amounting to 84½ per cent. of the total cost of production. Most of the Bessemer ore used in Great Britain is now imported from Spain, the deposits of West Cumberland and North-west Lancashire only supplying about 2,500,000 tons a year, as against about 4,000,000 tons imported. According to the contributor of the article on the Mineral Industries of the United Kingdom in Rothwell's "Mineral Industry," 1892,—"About 20 per cent. of the total make of pig-iron in the United Kingdom is now and has for some years past been produced from imported ore, a large part of which is delivered to the furnaces at 11*s*. per ton, the average content of iron being 50 per cent." The proportion quoted is stated to have risen to 25·2 per cent. in 1892. (Engineering and Mining Journal, 1893, page 494.) From the above tabular statement it appears that during the period of Mr. Wright's investigation, the average Bessemer ore used at four British Establishments cost per ton \$3·39 = (14*s*. 1½*d*.) and yielded 55½ per cent. of pig iron, which we may take as equal to say 53½ per cent. of pure iron. Allowing for losses in smelting we may estimate that the ore would assay about 57 per cent. iron. According to the return of imports into the United Kingdom during the same period (1887 to 1890), the average value of the imported ore (which is mostly Bessemer ore) was 15*s*. a ton. It is probable that the recent heavy fall in the value of silver will have lowered the price of Spanish ore, as Spain is monetarily a silver standard country. In estimating the relative prices at which the British and Australian smelters respectively would purchase their Bessemer ore, I do not think, therefore, that we should put down the cost to the former at more than 11*s*. a ton, the price quoted by "The Mineral Industry's Contributor."

At what price, now, could we deliver the Blythe River ore to a smelting establishment? Taking into consideration that coke is a bulky, and therefore expensive cargo to carry, and that, as shown above, nearly as much weight of coke as of ore is used in the first smelting, without counting the coal and coke used afterwards in converting the pig iron into merchantable rails, rods, sheets, and so on, it is pretty clear that it would be cheaper to send the ore to Newcastle to be smelted than to try to reduce it in Tasmania. This would have the further advantage that the metal made would be at once available for distribution throughout New South Wales and Queensland, without the expense of freight from Tasmania. Smelting at Newcastle seems to me the only hope of success with the Blythe River and Penguin ore.

The mine being admirably situated for mining the ore cheaply, it seems a quite safe estimate, even after allowing that a good deal of second class ore unfit for smelting had to be moved and rejected while picking out the pure mineral, if we put the cost of winning it at 3*s*. a ton. The distance to Burnie Breakwater being 12 miles, another shilling should cover the freight to the port. The freight from Burnie to Newcastle will be a very important factor in the calculation, and I have been at some pains to get reliable figures on this head. Seeing that vessels taking coal and coke from Newcastle to Melbourne, Adelaide, and Port Pirie can call at Burnie on their return trip and load with iron ore, it is pretty certain that if shipments of 800 or 1000 tons of ore a week (enough to keep one large furnace in work) or over could be guaranteed to the shipping companies, contracts could be made to carry it at 5*s*. a ton. Allowing 2*s*. a ton for contingencies and profit, the ore could then be delivered at Newcastle for about 11*s*. a ton, or about the same price as the British smelter pays for his Spanish hematite.

As regards the price of coke, however, the position is much less satisfactory. While the British smelter pays, as shown above, from 9*s*. 4*d*. to 10*s*. 6*d*. a ton for his coke, the best coke delivered in Newcastle costs 25*s*. a ton. As the best coal is now sold in Newcastle in the trucks at 7*s*. 9*d*., and small coal at 4*s*., it seems likely that coke could be supplied considerably cheaper, probably at not more than 20*s*. a ton at the outside, if a local furnace were in a position to make large contracts for it. The quality of the New South Wales coke is not perhaps quite as good as the English, but is susceptible of improvement with the use of coal-washing appliances and greater care in manufacture. In a report, dated 22nd December, 1892, by the Government Geologist of New South Wales, Mr. E. F. Pittman, it is pointed out that there is not so much difference between the English and German cokes and the best New South Wales makes as is generally supposed. After comparing the analyses of nine samples of foreign coke supplied to the Broken Hill and Port Pirie smelting works with those of fourteen samples made in different parts of New South Wales, he says :—"It will be observed that some of the Welsh coke used at Broken Hill contains a higher percentage of ash than the colonial coke made by either the Purified Coal and Coke Company, Wallsend, or the Singleton Colliery Companies; also that the *average percentage* of ash, calulated from the nine samples of foreign cokes in use at or in transport to Broken Hill amounts to 7·26, which is only 0·6 per cent. lower than is contained by the coke made at the Purified Coal and Coke Company's ovens, Wallsend." Mr. Pittman summarises his conclusions as to the relative quality of the New South Wales and foreign cokes as follows:—"Some of the cokes at present manufactured in New South Wales are nearly equal, as regards ash, to the *average* of the imported cokes in use at the Broken Hill smelting works. Several of the cokes at present manufactured in New South Wales are superior, as regards per-centage of ash, to some of the imported cokes in use at Broken Hill. That in regard to strength, or capacity for resisting pressure, the cokes manufactured in New South Wales are superior to some of the imported cokes at present in use at Broken Hill."

The ash of the New South Wales cokes is admitted to be somewhat more siliceous, and consequently more refractory to smelt than that of the average English ones, but as a set-off to this it contains less sulphur and phosphorus. In the Records of the Geological Survey of New South Wales, Vol. II., Part III., 1891, page 110, it is stated in a paper by Mr. J. C. H. Mingaye, F.C.S., Government Analyst, that "as regards the presence of sulphur, the coals of New South Wales are exceptionally free from that element, and I think will, without doubt, compare in this respect with coal in any part of the world." At page 114 of the same paper Mr. Mingaye again says—"The ashes of the coals of New South Wales yields much less phosphoric acid than the English, which is greatly in their favour when the coals or cokes are required to be used for iron-smelting purposes," and he quotes the mean percentage of phosphoric acid in five samples from the Northern District of New South Wales as ·726 per cent., and in six from Great Britain as 1·843 per cent. The purity of the coke from sulphur and phosphorus will allow of the production of very fine iron from the pure Tasmanian ore, and is an advantage which few but iron-smelters will adequately realise.

As a set-off against the siliceous ash of the Colonial coke the great purity of the ore might be urged, but it would be premature to do so until actual shipments have been sampled. If the ore can be kept of the same average grade as the Spanish ore, say from 50 per cent. to 65 per cent. iron, it is as good as we have any right at present to expect it to be, though there is much reason to hope that a higher average value could be maintained.

Taking the English figures above given for Bessemer pig iron as a basis, we may now attempt a rough estimate of the cost of producing a ton of pig at Newcastle:—

	£	s.	d.
1·8 tons ore, at 11*s*.	0	19	9½
·07 tons cinders, &c., at say 2*s*.	0	0	1½
·345 tons limestone, at 4*s*.	0	1	4½
1·2 tons coke, at 20*s*.	1	4	0
Total materials	£2	5	3½
Labour, officials, supplies, &c., say	0	10	0
Total cost of pig	£2	15	3½

As against $10·33 or £2 3*s*. 0½*d*. in England, the extra cost being about 12*s*. 3*d*.

The handicap which the colonial smelter would have as against his English competitor is the freight on the latter's goods out from England. This is very variable, according to the exigencies of the shipping trade, ranging from occasionally a nominal sum up to as much as 25*s*. a ton. After a good many inquiries it seems to me to be pretty safe to take 12*s*. 6*d*. a ton as about the lowest average freight on iron from London to these Colonies. As regards New South Wales and part of Queensland the local smelter would have the whole of this in his favour; but when he had to ship from Newcastle to Melbourne, Adelaide, New Zealand, and Tasmania, it is doubtful whether the freight on his goods, owing to the high intercolonial rates prevailing, would not be almost as much as if they were sent from London. The Newcastle manufacturer would then have a slight advantage in New South Wales and Queensland, but could hardly meet English competition elsewhere in the Colonies. It must be remembered that the case of pig iron is the one most favourable to the Colonial smelter, as the higher rates of wages and coal here will make the further working up of the metal into merchantable shapes relatively more costly than in Great Britain.

It is possible that a powerful company acquiring the iron mines, and also coal mines of its own and making its own coke, might be able to reduce the cost of producing iron to a figure approaching the British cost, the facilities for bringing the ore and coke together at Newcastle, and for distributing the product afterwards, being really unusually good. The case in favour of a trial at making iron in these Colonies seems good enough to warrant its being investigated in all its details by a skilled specialist in the manufacture. The attempts hitherto made at iron-smelting have been failures, or very partial successes, but it seems to me that the proposal to reduce sea-borne ore at Newcastle has points in its favour which were wanting in other instances.

As showing the value of a deposit of high-grade Bessemer ore, the following notes on the iron deposits of Cuba, taken from "Rothwell's Mineral Industry, 1892," will be of interest:—"The Cuban iron-ore deposits, one of the most important groups of Bessemer iron mines in the world, are found on the range of mountains called the Sierra Maestra, which skirts the southern coast of the Province of Santiago de Cuba. The ore can be mined with great facility by means of side-hill cuts. The average analyses of the cargoes have been between 58 per cent. and 65 per cent. of metallic iron, and about 0·02 per cent of phosphorus." A syndicate of Pennsylvania capitalists obtained a concession to build a narrow-gauge railroad from the mines to the port of Santiago de Cuba, a distance of 17 miles. "The line was laid through a very mountainous country, and the first car-load of ore was shipped late in 1884. Since then the output has been increasing year by year, and in 1891 it amounted to 330,000 tons. To haul the ore from the mines to the port there are at present in use about 20 locomotives and over 2000 cars, while the total number of men employed averages about 1500. The company has built an iron pier at the harbour of Santiago de Cuba high enough to allow the railroad cars to dump directly into the steamers. There are no ore-docks, so the company must have sufficient cars to allow the loaded ones to be side-tracked until the arrival of the steamers, every two or three days. The company controls a regular line of iron steamers plying between their pier at Santiago de Cuba and Philadelphia or Baltimore. Most of the ore is consumed by the Pennsylvania Steel Company and the Bethlehem Iron Company. It is estimated that over $3,000,000 has been spent in this enterprise, with gratifying financial results. In 1890 the Sigua Iron Company, composed of Philadelphia capitalists, was organized, and purchased another group of mines in the same mountain range, about 30 miles from Santiago de Cuba. It has constructed eight miles of standard-gauge railroad. An ore-dock of 5000 tons capacity was built in the open sea, and will be protected from the prevailing south-east winds by a breakwater now in process of construction. The first shipment of ore from this group of mines arrived in Philadelphia a few weeks ago in the American whale-back steamship '*Joseph L. Colby*.' A portion of the cargo went to the Midvale Steel Company, whose analysis gave:—Metallic iron, 67·576 per cent.; phosphorus, 0·014 per cent.; sulphur, 0·026 per cent.; silica, 1·400 per cent."

The importance to all the Australian colonies of the establishment of an iron-smelting industry in their midst can hardly be over-estimated, seeing that there is, perhaps, no other that gives a greater stimulus to national progress. If it can be successfully established it will go far before long to render us less dependent upon the outside world for markets for our foodstuffs and raw materials and for manufactured goods, by encouraging a manufacturing population who will consume the former and supply the latter, for the development of coal and iron industries always carries with it progress in other branches as well. The question of fostering it by the removal of restrictions on intercolonial trade and by other means is therefore well worth the consideration of colonial statesmen.

In conclusion, I would urge the owners of the Blythe River mine to have the deposit opened out by mining works far enough to allow accurate estimates 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 it has been miscalculated, and to have the whole question of smelting it and disposing of the iron thoroughly looked into by an experienced iron manufacturer. In my opinion the time has come for such a thorough investigation of both mine and market, and the magnitude of the issues at stake demands that care and expense should not be spared in these most necessary preliminaries. I have to thank Mr. Wm. Jones, of Burnie, Mr. J. W. Norton-Smith, Mr. J. T. M'Donald, of Salisbury's Foundry Company, Launceston, and Messrs. Huddart Parker & Co.'s and the Union S.S. Co.'s, of New Zealand, Managers, for much information as to freights, &c.; the Government Statistician, Mr. R. M. Johnston, for tables of iron imports into the Colonies, and the Under Secretary of Mines, Sydney, for information as to prices of coal and coke at Newcastle, and for Reports on the Coals and Cokes of New South Wales.

I have the honour to be,
Sir,
Your obedient Servant,

A. MONTGOMERY, *Geological Surveyor*.

The Secretary for Mines, Hobart.