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THE BLYTH RIVER IRON DEPOSITS.

The gold produced per annum throughout the world is about 13 million ounces; the amount of iron produced per annum is about 40 million tons. In other words, the value of the crude iron produced per annum is more than double the value of the gold raised. Ausrtlasia produces nearly one-third of the total gold raised, but, although possessed of the finest ironstone deposits in the world, does not produce iron from the raw ore. Several attempts have been made in New South Wales to start iron smelting, and, curious to relate, as far back as 1867, 90 tons of pig iron produced in New South Wales were sold in San Francisco, and relise £6 per ton, and afterwards some hundreds of tons were shipped and sold for satisfactory prices, In New Zealand, in Tasmania and in Victoria attempts were made to produce iron of large scale years ago, but the enthusiasm of the promoters of such enterprises was in advance of the technical skill at their command. All these efforts failed. Since that time Australia has become seperated from the Mother counrty by a new generation and the production of iron is not viewed in the same way as it was years ago. Nowadays, it is comparatively easy to say, from the analyses of ore and fuel what class of iron can be produced from a given ore, at what cost it can be mined and smelted, and what the profit or loss on the operation would be. The low freight of pig iron from the old country, it being practically carried as ballast, the cheep rate of production, and the fact that the various States admitted iron or steel required for the construction of railways free of duty, have all precluded the idea of establishing ironworks to produce iron in Australia. So long as we are content to go on in this way our enormous iron deposits will stand out as monuments to our lethargy and indifference. On the other hand, if ironworks are to be started it means that they must be such as to supply all the States with pig iron and ordinary steel; it means that a whole army of workman must be trained to work entirely new to them, and it means the expenditure of at least a million sovereigns before a ton of pig iron could be turned out. More than this, it means that the States must be the largest customers to such works, so that before such a sum of money is found for Austr- alia, investors want some guarantee that State custom will be given to the works, and that some bonus should be given for establishing such an industry and taking the risk. It is natural that some of the representatives of the Commonwealth, seeking that the States would be large customers, desire that such works should be established under Government control. State management would mean failure for an enterprise competing with the keenest rivals in the world. Operations in this case could not be reduced to the red tape routine; while the officials

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would not dare to depart from the old-time methods, and would thus be left hopelessly in the rear, leaving the States to make up an everincreasing deficit. It is to be hoped for the sake of the taxpayers that such a scheme will never be advocated seriously.

It is certain that in course of time Australia will be producing iron, and there is no reason why a start should not be made at once. The money can be found for starting the industry, permanent employment of thousands of people would be guaranteed, and our deposits of coal and iron opened up and developed. The high price of labour in our States as against that of European and Asiatic countries will be more than compensated, as in America, by the extensive use of labour-saving machinery and natural resources. For instance, in America the cost of production per ton of iron is £1 12s. 6d., while in England it is £2 12s.

It was long held to be a sine qua non that iron ores and coal should be in proximity for successful iron smelting. Modern methods of transport have altered all this, and the result is that almost all the iron ores are carried for great distances. The ores from Lake Superior are carried 800 miles to Pittsburg, while rich Spanish and Swedish ores are conveyed over 1000 miles to Great Britain. A disturbing centre for the finished product is of importance, as well as the site of the ores and fuel. The amount of fuel and fluxes required will vary with the weight of the ore. Ores running 60 per cent. and over will take about half their weight in coke and about three-eighths their weight in limestone, so that the weight of coke and fluxes is about equal to the weight of iron ore. With low grade ores much more would be taken. If coal is used in place of coke from 30 to 40 per cent. extra would have to be added on the weight of the fuel. These considerations show that it is desirable to establish central works near a suitable harbor on some field which produces a first class coal.

Nearly ten years ago samples of an exceedingly pure hematite were sent over from Burnie Tasmania, with a notification that they came from Blyth River. These consisted of ferric oxide with traces of phosphoric acid, silver, copper and gold. Since that time I have had many samples from the same place, but all analysis showed that ores were exceedingly pure. A syndicate was formed to develop this property, and about £35,000 has been spent. A gentleman of very high repute in England, Mr. Darby, was engaged at a fee of £3000 and traveling expences amounting to nearly another £1000, to report on the proposed scheme. Mr. Darby's report was very exhaustive, and included

(1) the deposits of hematite iron on the Blyth River, (2) the site of the proposed works, (3) the sources of fuel, (4) the manufacture of steel, (5) estimates of the outlay. Although much of the information was given is the property of the syndicate, it is only necessary to indicate that the report was wholly favourable. The site for the works was fixed at Ryde, on the Paramatta River (N.S.W.) It was proposed to have a fleet of ships from Tasmania to Sydney carrying ore to the extent of nearly 1000 tons per day, while the works would turn out 150,000 tons of steel per annum. The field which was to supply this for 20 years at least was in Tasmania and on the Blyth River. The mine is situated on the north west coast of Tasmania, about six miles from the mouth of the Blyth River and about 150 feet above the level of the sea. The picturesque town of Burnie is about ten miles away. Through the courtesy of Messrs. Wm. Jones and Son I was enabled to visit the mine and obtain particulars of work done. The country in the neighbourhood is hilly, the hills being covered with a decomposed basalt giving a rich chocolate soil. Near the river the basalt disappears and the country becomes more rugged. A gorge, some 500 feet deep, has been cut by the Blyth River, and on both sides massive monoliths, of hematite rise from the river bed to the summit of the hill, showing where the deposit has been cut through by the eroding stream. In the bed below great blocks of pure hematite may be found a long way below the source of supply, and it would appear as if thousands of tons could be picked up in the bed of the stream. The outcrop runs N. 27 deg. E., and may be traced for a mile, while it continues both north and south for a much greater distance. For about 20 chains on the north side of the river patch of basalt overlies the iron stone, but independent of this there is a vast amount showing. The deposit is nearly vertical and its outcrop rises some 600 feet above the bed of the river. It appears to be interbedded between the slates and sandstones. The width at the surface has been approximately determined by means of trenches and tunnels. On the south side, about 100 feet above the river it measures, according to Mr. Twelvetrees, 147 feet, and consists of hard hematite; higher up the hill it measures, as exposed by a trench, 260 feet, but contains more silica. Near the top of the hill is a huge isolated block of solid ore known as the purple crag. The width is over 100 feet. At the river level the ore is exposed for over 30 feet, and as the northern slope is ascended the width increases to over 107 feet. Mr. Darby had several tunnels driven in order to define the outcrop. The lower tunnel is at the base of the northern bank of the stream. This was driven along the deposit for 225 feet. Crosscut into the ore were driven at frequent intervals. The first, at 30 feet, was put in for 12 feet, and last 6 feet being in pure hematite; the second, at 45 feet, was driven 6

feet into ore; the third, at 66 feet, was driven for 10 feet. part of the material being jasper; the fourth, at 77 feet, for 17 feet, all in solid hematite; the fifth, at 142 feet, cut into good ore; the sixth at 199 feet, into ore; the seventh at 225 feet, into good ore for 13 feet. Analysis of specimens selected by Mr. Twelvetees and determined by Mr. Ward, the government Analyst:-

Crosscut at	Iron %	Silica. %	Phosphorus %	Copper %	Sulphur %
66 feet	46.0	34.2	Nil	Nil	Nil
77 "	65.0	7.0	"	"	"
142 "	67.2	3.8	"	"	"
167 "	68.1	2.4	"	"	"
199 "	68.5	2.0	"	"	"
225 "	68.7	1.6	.04	"	traces

The second tunnel, or upper tunnel put in by Mr. Darby is driven through the deposit at the northern end. It entered ore at 79 feet from the surface, and was driven through ore for 84 feet. This gave 60 per cent. iron and 14 per cent. silica. A large amount of work has been done on the property, which has made assurance doubly sure with regard to quality and quantity. The members of the syndicate deserve great credit for the painstaking way they have proved the property. They have shown beyond doubt that the ironstone is not a mere superficial capping over some pyritic body, and that at least down to the river level it has maintained its dimensions and quality.

The specific gravity of the average Blyth furnace ore is 4.807, so that a cubic foot weighs 299lb, and a cubic yard 3.6 tons. Taking the length of the deposit as 6000 feet and the depth from the surface only to the level of the river - assuming an average height of 450 feet, with 100 feet, and length 6000 feet - this would give 450 x 100 x 6000 cubic feet, or 270,000,000 cubic feet, or 10,000,000 cubic yards or 36,000,000 tons. Mr. Darby estimates the available supply, after having his estimates, at 24,500,000 tons, or if 300,000 tons were smelted per annum this one mine would only be worked down to the river level in 82 years. The iron contained in this may be estimated at 14,000,000 tons, worth about 50 million pounds. The weight of iron used by Australia per annum as steel rails, sheets, girders, and wire is about 250,00 tons so that this one mine could supply the Commonwealth for half a century. The analysis of the ores as obtained by Mr. Darby I have been enabled to obtain through the courtesy of Mr. Wm. Jamieson, chairman of the Blyth River Iron Mines, Ltd. Mr. Darby divides his samples into four parts

No 1, taken from outcrop north of basalt coverings: Ferric oxide, 93.64 per cent; iron, 65.54 per cent. silica, 5.19 per cent. No 2, taken over the slope to the river on N.E. side, Ferric oxide, 85.93 per cent. iron, 60.15 per cent silica, 12.41 per cent. No 3, taken over S.W. slope: Ferric oxide 85.38 per cent. iron, 59.76 per cent. silica 11.09 per cent. No 4, waterworn boulders in river and north of deposits: Ferric oxide, 97.08 per cent. iron, 67.95 per cent. silica 1.13 per cent.

An average sample of the whole deposit gives the following complete analysis:-

			Per cent.	
Ferric oxide (Fe <sub>2</sub> O <sub>3</sub> )	.. ..		86.934	) 63.259 of iron
Ferrous oxide (FeO)	.. ..		3.074	
Silica (SiO <sub>2</sub> )	.. ..		7.312	
Alumina (Al <sub>2</sub> O <sub>3</sub> )	.. ..		1.756	
Lime (CaO)	.. ..		0.068	
Magnesia (MgO)	.. ..		0.071	
Sulphur trioxide (SO <sub>3</sub> )	.. ..		0.060	0.024 sulphur
Phos. pentoxide (P <sub>2</sub> O <sub>5</sub> )	.. ..		0.083	0.036 phosphorus
Titanic acid (TiO <sub>2</sub> )	.. ..		0.03	
Copper	.. ..		trace	
Arsenic	.. ..		trace	
Manganese	.. ..		trace	
Chromium	.. ..		none	
Combined water	.. ..		0.324	
Moisture	.. ..		0.160	

99.892

Mr. Darby also took a sample of the ores and reduced it with coke, using lime for flux, and obtained a cast iron button. This on analysis gave:-

		Per cent.
Carbon	.. ..	1.800
Silicon	.. ..	0.032
Pho-phorous	.. ..	0.062
Sulphur	.. ..	0.092
Manganese, chromium and titanium		Nil

Since the coke ash used would give 0.5 per cent. of phosphorous, and part of the sulphur was introduced from the burning of the fuel, it is evident that by smelting with a good limestone that an excellent hematite pig suitable for manufacturing a high class steel could be

produced. The yield obtained by fire assay was 66.5 per cent of the ore used, and 12.5 per cent. of the limestone was added on the weight of the ore.

A railway could easily be constructed from Burnie to the mine. Ocean-going steamers could be loaded direct from the trucks, so that the freight from the mine to vessel would not exceed 6d. per ton, while the breaking of the ore and loading of trucks would not be more than 3s. per ton, or a total cost 3s.6d. per ton. There are not many places in Australia as favourably situated as this; but there are many fine deposits in Victoria, Queensland and South Australia, whose ores no doubt would be sought for the manufacture of special classes of pig iron steel. The deposits at Nowa-Nowa, at the head of lake Tyers, Gippsland, contain manganese; those at Beaconsfield (T) chromium; while fine deposits of magnetite occur on the Fitzroy River, and near the coast of Central Queensland.