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REPORT ON THE
COAL MINING INDUSTRY IN
THE HOKKAIDO.

EDITED AT THE FOREIGN OFFICE AND THE BOARD OF TRADE.

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Measures and money referred to in this report :—

1 mm (millimetre)	=	0·039 inch
1 metre		39·37 inches
1 tsubo		3·593 square yards
1 sen		$\frac{1}{4}$ d. (about)
1 yen (100 sen)		2s. 0 $\frac{1}{2}$ d.

Report on the Coal Mining Industry of the Hokkaido by Mr. H. Wrenacre, Student Interpreter in the British Consular Service in Japan.

Before the year 1869, when immigration was actively encouraged by the Japanese Government, the Hokkaido was of no practical economic or commercial value. About that time official investigations into its resources were made, the Government initiating various commercial enterprises which were subsequently transferred to private hands. The result of these investigations was the conjecture that the latent mineral wealth of the island was considerable and would well repay exploiting. Of the minerals, coal was found to be the most abundant. The first discovery of this mineral was made in 1854 at Sorachi, Ishikari Province, by Takeshiro Matsura, the famous explorer of the Hokkaido.

Discovery.—Although the presence of coal was thus made known at a very early date in the commercial history of the Hokkaido, nothing was done until about 1874, when a Mr. B. S. Lyman, an American geologist in the service of the Imperial Government, visited the locality and made a report on its resources. About this time he also made a survey of the adjacent Poronai coalfields, discovered by a lumberer in 1868, and while in the locality reported that he had discovered coal in the Yubari district. The period 1874 to about 1876 therefore really marks the commencement of the Hokkaido coal industry. Unfortunately, owing to the roughness of the Yubari district, Mr. Lyman's discovery of coal in 1876 received no practical attention, and it was not till 1888, when another coal seam was found in the same neighbourhood, that the matter was taken up and what has proved to be the most valuable and extensive mine seriously exploited.

Extent of the coalfields.—At that time little or nothing was known of coalfields other than those of the Ishikari district, and estimates of the island's mineral wealth were practically confined to the prefecture of that name. Even to-day this district is the only one of any serious importance, and constitutes the centre of the coal mining industry, but investigation has gone to prove that coal also exists along the western slope of the central mountain range which cuts off the Eastern from the Western Hokkaido. Coal-beds again have been found on the south-east coast. The presence of coal on both sides of the central mountain mass at one time was held to be indicative of connecting seams stretching across the island, but subsequent investigations show that the Central Hokkaido has been denuded of its coal-bearing strata.

Estimated quantity of coal in the Hokkaido.—This denudation has fortunately not extended very far, and the lateral slopes, particularly on the west, are said to contain considerable quantities of mineral. Estimates of the coal resources of the island have been made from time to time. Already in a report made in 1891 by the engineer to the Hokkaido Administration the quantity of coal contained in the fields examined up to date was estimated at 600,000,000 tons. It has since been discovered that that estimate was singularly low. When therefore it is remembered that the total output of coal from the whole of the Hokkaido barely exceeds 1,500,000 tons per annum, and the estimated resources of the rest of Japan are under 800,000,000 tons, the prospects of a successful development of the industry in the Hokkaido are, as far as latent resources go, exceptionally favourable.

Principal mines and their owners.—At present the development of these resources is, as already stated, chiefly confined to the Ishikari Prefecture. There are numerous collieries here, both large and small, the most important of which are Sorachi, Poronai, Ikushunbetsu, Yubari No. 1, Yubari No. 2, Shinyubari and Pompetsu. Of these seven mines the first five are owned by one company, the Hokkaido Tanko Kisen Kabushiki Kwaisha (Hokkaido Colliery and Steamship Company)—a very powerful commercial institution, virtually controlling the coal business of the Hokkaido, and as to which a few details are given later; and the remaining two respectively by the Ishikari Sekitan Kabushiki Kwaisha (Ishikari Coal Company), owning Shinyubari, and the Nippon Kogyo Kabushiki Kwaisha (Nippon Industrial Company), owning Pompetsu. A complete list of the mines of the Hokkaido is given in Table 5 of output and value for the last two years (1909–10). Of the seven mines above mentioned Yubari No. 1 is by far the most important—contains the best quality coal, employs the greatest number of workmen, the most up-to-date mechanical contrivances and has twice as great an output as any of the mines of the island. Second in importance comes Sorachi, which, although the oldest mine, is still in a flourishing condition and comes second as regards output.

A few details concerning these collieries are not without interest and are given in the appendix.

Geology.—The coal measures of the Ishikari coalfields are deposited on tertiary cainozoic group and are associated as usual with sandstone and shale, the latter predominating very much—in fact, the whole countryside in this district is composed almost entirely of tertiary strata.

Coal seams.—The number of coal seams varies from two to twelve, but the average number workable is four to five. They vary in thickness from 2 feet 5 inches to 60 feet in one case (Yubari No. 2), but the usual thickness is 5 to 6 feet.

The seams are usually much disturbed with many faults, the dip of the measures varying from 5 to 80 degrees; while at Sorachi, where the disturbances are most marked, the seams are sometimes vertical. At Yubari No. 1, however, they are very uniform, the maximum dip so far encountered not exceeding 30 degrees.

Table 1.—NUMBER, Thickness and Maximum Dip of Seams at the Seven Principal Mines.

Mine.	Seams.	Maximum and Minimum Thickness.		Maximum Angle of Dip.
		Ft. ins.	Ft. ins.	Degrees.
Sorachi ...	12	3 0	6 6	80
Poronai* ...	5	2 7	5 0	70
Ikushunbetsu ...	4	3 6	7 0	80
Yubari No. 1 ...	3	3 0	24 0	30
	2 (Manji)			
Yubari No. 2† ...	8	4 0	10 0	70
Shinyubari ...	3	6 0	10 0	75
Pompetsu ...	12	3 0	10 0	55

* No. 2 is 19 feet, but only 5 feet is workable. † No 1 seam is 60 feet thick.

Quality of coal.—The quality of the coal obtained from the Hokkaido mines is generally excellent, as will be seen from the following table. There are two principal kinds—(1) bituminous caking coal, particularly suited for coke and gas making (chiefly found in Sorachi, Yubari and Shinyubari), a dirty coal for steam purposes, in spite of its excellent combustion and small percentage of slack; and (2) bituminous non-caking coal, which is very hard, with a brilliant lustre, and has acquired a high reputation in the market for steam coal. The best is found at Poronai. On the whole, however, the best coal is found at Yubari No. 1; indeed, this coal is generally considered to be the best in Japan.

Table 2.—ANALYSIS of Coal Produced at the Seven Principal Mines.

Mine.	Description.	Specific Gravity.	Moisture.	Volatile Matter.	Fixed Carbon.	Ash.	Sulphur.
Sorachi ...	Bituminous caking coal	1.267	0.890	32.368	59.826	6.740	0.176
Poronai	Bituminous non-caking coal	1.262	3.835	44.175	48.817	2.960	0.213
Yubari No. 1 ...	Bituminous caking coal	1.223	1.120	46.588	49.585	2.440	0.267
Yubari No. 2 ...	Bituminous caking coal	1.227	1.590	43.575	53.535	1.110	0.190
Ikushunbetsu ...	Bituminous non-caking coal	1.242	2.070	49.242	44.463	4.090	0.135
Shinyubari	Bituminous caking coal	2.250	2.150	43.250	52.000	2.600	0.230
Pompetsu	Bituminous caking coal		2.470	42.180	49.880	5.470	0.340

Output.—The output of coal from the Hokkaido is of no very great value and does not exceed 1,000,000 $\frac{1}{2}$., but it is by far the most important production of the island, and a glance at Table 3 (below) will show that it has been steadily on the increase. Compared with the output from the whole of Japan the Hokkaido coal production averages about one-tenth, growing consistently with the national production. It ranks second on the list of coal-producing districts, that of Fukuoka coming first.

It is a curious fact that in spite of the gradual increase of coal production in the Hokkaido and the rest of Japan, there has been no increase in value for the last five years. In 1906, when the output of Japan was 12,000,000 tons, the value was 63,000,000 yen. The value was the same in 1908 (see Table 4), though the output had increased 2,000,000 tons; and in 1909 it went down to 58,000,000 yen, though there was a slight increase in production. In the Hokkaido the same circumstances are met with. During the years 1908–10 the production has been fairly steadily maintained, but the value has gone down 2,000,000 yen. This state of affairs is accounted for in the Hokkaido by the fact that—(1) the introduction of labour-saving devices and improved machinery has enabled the coal produced to be sold at a reduced rate, hence causing a reduction in value per ton; and (2) the output has been greater than the demand, and the coal mines have had a large quantity of accumulated coal in their hands, thus forcing them to reduce their prices. This cause, moreover, explains the slight reduction in output occurring last year (1910), which must not, the companies assert, be taken as a sign of exhaustion of the mines. Indeed, the prospects for 1911 show a tendency to an increased production.

The impetus given to the output in 1906 and 1908 is due to the opening and rapid development of three new mines at that time, namely, Yubari No. 2, Pompetsu and Shinyubari.

Table 3.—OUTPUT of Coal in Tons from the Hokkaido for the Years 1904–10 compared with the Output of the whole of Japan for the same Period.

			Hokkaido. Tons.	Japan. Tons.
1904	...	...	1,078,168	10,723,796
1905	...	...	1,177,511	11,542,397
1906	...	...	1,454,018	12,980,163
1907	...	...	1,384,349	13,803,969
1908	...	...	1,607,304	14,825,363
1909	...	...	1,691,269	15,048,113
1910	...	...	1,591,699	15,681,324

Table 4.—VALUE of Output of Coal from the Hokkaido for the Years 1908–10 compared with that of the Production of the whole of Japan.

				Hokkaido. Yen.	Japan. Yen.
1908	...	...	...	8,814,455	63,623,773
1909	...	...	...	8,645,099	58,213,680
1910	...	...	...	6,265,387	50,483,238

The following table (5), drawn up by the Hokkaido Mining Inspection Office, shows the output and value not only for the leading collieries, but also for the many secondary mines which have been opened all over the country. These figures are the only information available concerning these latter enterprises, as the owners issue no detailed reports concerning their staff, plant or methods of working. Judging, however, from the smallness of the output and value it is doubtful whether there are any items of interest in this connection worth recording.

The output and value are in many cases very erratic, owing to the fact that the mines are still in their infancy and have not yet been got into proper working order; indeed, some may be regarded rather as experimental ventures than permanent business concerns.

Details of output from the seven principal mines for the last 10 years (1901-10) are given in Table 6.

Table 5.—OUTPUT and Value for all the Mines in the Hokkaido during the Years 1909-10, according to the Hokkaido Mining Inspection Office.

Mine.	1909.		1910.	
	Tons.	Yen.	Tons.	Yen.
Sorachi	314,830	1,433,010	204,457	781,026
Poronai	197,745	959,808	170,416	777,097
Ikushumbetsu	77,679	374,685	83,668	362,282
Yubari No. 1	513,682	2,938,693	471,372	2,286,154
Yubari No. 2	140,829	804,668	128,670	609,896
Shinyubari	157,820	923,636	153,888	378,564
Pompetsu	69,013	295,811	104,255	305,467
Oyubari	21,102	120,721	23,633	53,883
Naie	15,329	48,267	17,255	24,502
Nakanura	29,970	102,118	44,831	83,834
Monju	17,098	60,779	24,602	80,941
Kayanuma	10,205	31,526	11,502	39,967
Saito	12,056	54,252	8,893	36,639
Owada	44,522	200,349	26,689	94,746
Harutori	19,194	85,221	18,394	78,358
Beppu	12,648	56,916	13,460	57,888
Osaka	16,357	69,677	19,679	69,860
Others	21,190	84,962	51,645	205,386

The progress made in developing the coal industry of the Hokkaido can best be judged from the following table (6), compiled from statistics obtained from the mine owners and the Department of Agriculture and Commerce. Any discrepancies which there may be between the figures under the 1909 and 1910 columns of this table and those of Table 5 are due to the difference of sources from which they are drawn.

Three of the seven principal mines have opened business since 1904, and here the development has been rapid. In the case of the remaining four, although they show in every case an increased output

for 1910 as compared with 10 years ago, that increase is, in view of the period over which it is spread, not very great, and the general impression is that these mines have maintained a fairly uniform production. The slight decrease for the year 1910 is due, as already explained, to the production of the preceding year being in excess of the demand, and to other business reasons. There is every indication that this year's (1911) output will show an increase.

Table 6.—OUTPUT in Tons of Coal from the Seven most important Ishikari Collieries for the Years 1901–10.

Mine.	1901.	1902.	1903.	1904.	1905.	1906.	1907.	1908.	1909.	1910.
	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.
Sorachi	187,918	205,326	152,481	166,458	211,559	228,010	201,293	251,351	312,330	204,455
Poronai	168,932	193,339	212,752	193,382	203,524	205,074	167,903	190,276	196,176	170,415
Ikushunbetsu	46,343	64,460	98,227	80,160	83,042	84,380	67,946	78,081	77,062	83,667
Yubari No. 1	348,651	422,562	460,094	465,399	462,321	541,726	476,986	495,963	509,605	471,371
Yubari No. 2 ... ..	...	...	...	...	3,028	67,604	84,011	118,596	139,710	128,678
Shinyubari ... ..	...	...	...	...	...	...	77,196	168,046	130,373	119,051
Pompetsu ... ..	...	...	...	6,000	7,200	12,000	44,474	84,348	69,014	87,310

Method of mining.—The method employed in the Ishikari coal mines is to drive entry levels along the strikes of the seams from convenient outcrops of the seams or slopes along the dips. Where this method is inconvenient or impossible, shafts are sunk from the surface or tunnels cut through the outer rock; underground shafts are also sunk within the mine from slopes in order to work seams below the drainage level. At points every 500 feet along the slope the main or exploring roads are set away to the right and left at right angles to the slope along the strike of the measures. The entry levels and slopes, together with these exploring roads, are laid out with double lines of 12-lb. rails of 50-centim. gauge. The general method of working is to drive rise-headings about 50 to 60 feet apart, centre to centre, from the main or exploring roads of the slope (or from the entry levels). These headings are from 12 to 15 feet wide, are furnished with double lines of rails with a simple self-acting arrangement consisting of pulleys and rope, so as to lower the coal from the working face. Headings adjacent to one another are connected by thirlways about 50 to 60 feet apart, forming with the headings, stoops or pillars from 35 to 50 feet square. When the seam is thick only the lower portion of coal is taken. Then when the headings have been driven up to their limit, the working of the upper portion, together with the robbing of pillars, is commenced, and continued to a limited distance from the main or exploring road or from the entry level. The method of working the upper portion of coal and the robbing of pillars at the same time is similar to the method of long-wall retreating, leaving goaves behind and using the same self-acting inclines on the headings to lower the coal. As the roof is usually a soft shale, a thin layer of top coal is left, and this forms a fair support when working the whole. The goaves are separated into districts or panels of usually 500 by 1,000 feet, isolated from each other by strong barriers of solid coal, so as to confine the damage to a limited area in case of accident.

Miners use the common pick and shovel in coal-getting, breaking away the under coal so that the upper falls naturally when lightly tapped. When a certain quantity has been accumulated in this way it is shovelled to the mouth of a wooden drain, whose outlet is the main roadway beneath. This outlet is conveniently placed over the car rails and fitted with a trap to regulate the outflow when a train is being loaded. This drain is continually extended as the miners proceed. When a trainload is complete it is drawn by pit pony either direct to the screening sheds or else to the foot of the nearest hauling or winding plant, whence it is hauled or raised to the surface and passed by hand, horse or endless rope to be screened.

Although the pick and shovel are the usual instruments employed, dynamite is used in breaking a fault or in stone-driving in forcing rise-headings and entry levels. In the largest mines, pneumatic rock drills and coal-mining machines have been used for driving entry levels and undercutting coal, and will be gradually adopted in the more important mines. For ordinary use miners carry benzine safety lamps fitted with magnetic locks, but Clanny and Davy lamps, burning vegetable oil, are also used. Pieler's lamps are used for detecting fire damp. Shot fire is generally

prohibited for fear of explosion, but where safety is precautioned Carbonit No. 1 is used exclusively by expert shot firers.

A tunnel having been blasted or excavated by manual labour, the sides and roof are supported by wooden boards and posts. The sides are first more or less levelled, and the boards, about 20 feet long and 1 foot broad, of proportionate thickness, are placed horizontally side to side, one above the other, and held in position by stout posts reaching from floor to ceiling. These upright posts incidentally support strong cross-beams, which serve to maintain the roof by holding boards firmly against it. Besides preventing the roof from subsiding, the boards also prevent dripping, and so keep the floor of the level dry. In the minor roadways the naked rock or coal forms the wall and ceiling, upright supports, with horizontal cross-beams erected at intervals of about 6 feet, sufficing to preserve the way. At distances of 1,000 to 1,500 feet along the principal slopes and levels, wooden partitions fitted with doors are placed to regulate the draught and enable ventilation to pass down the roads set off on either side. These partitions are placed at a slight angle with the perpendicular so that the doors, being set in the same plane, shut of themselves. At these partitions and usually at the parting of two ways a watchman's hut is placed. These watchmen are in telephonic communication with the nearest pit-mouth, so that information of accident can at once be given. Stables for pit ponies occur at convenient intervals within the mine, usually below drainage level, as it is simpler to house those working above that level in stables outside the mine. Those stabled in the mine are interchanged weekly with those outside.

Haulage.—A great part of the underground haulage is done by manual labour on single or double tracts of 12-lb. rails of 50-centim. gauge. Mine cars are of "end dump" type, holding $\frac{1}{2}$ ton of coal. Self-acting inclined planes are used where the difference of level is suitable. Pit ponies are used for drawing trainloads of trucks both underground and to the screening sheds. At Yubari No. 1 there are four (one spare) pneumatic locomotives, but nowhere else is this method of haulage employed. These engines, only 14 feet 10 inches in length and 4 feet 10 inches high, total weight in working order 12,500 lbs., are capable of hauling a trainload of 40 mine cars to the mouth of the pit. At Sorachi there are five (two spare) electric locomotives, with a speed of 6 miles per hour and weight of 6,000 lbs. These engines are only 7 feet long and are capable of drawing 15 loaded cars, each weighing about 1 ton, up a gradient of 1 in 40, the steepest gradient on the line.

Where the gradient is steep, steam hauling engines of the ordinary type and the endless rope type are used. In the latter case the cars are put on the rope by the Smallman patent clip. The velocity of the rope varies in every case, but an average is 150 feet per minute on a gradient of 1 in 3 or 4. In one case the speed attained is 600 feet per minute (Yubari No. 1), seven cars forming a train. It is usual to have secondary hauling machinery of small horse-power for short distances at convenient points.

The number of vertical shafts in the Hokkaido is very small, but where they have been constructed they are fitted with steam-driven

winding machinery. There are exceptions, notably at Yubari and Sorachi, where there are electric winding engines, the one at the latter mine being the most powerful in the island. It is about 180 horse-power, holds one tub in a single-deck cage and winds at the rate of 20 feet per second. The usual number of cars taken in the cages used in the Hokkaido is two, and no double-deck cages are found.

The engines employed for hauling and winding are mostly supplied by British and American firms, while the Temiya workshop of the Hokkaido Tanko Kisen Kabushiki Kwaisha has now begun supplying steam hauling-engines to mines owned by this company.

In some cases, owing to the distance from the mouth of the pit to the screening sheds and the roughness of the country, which does not admit of an ordinary system of rails being laid, the patent Tamamura system double (or single) ropeway is resorted to. This is an ingenious device consisting of a series of wooden posts supporting at intervals a steel rope from which are suspended bucket-shaped cars carrying a weight of from 560 to 1,400 lbs. each. By this means coal is carried a distance of over 6,000 yards over hilly country, the difference between the highest and lowest points of which exceeds 1,350 feet, at an expenditure of only 200 horse-power (electric), which gives a speed of over 110 yards per minute. This patent system of transportation is employed in four cases in the Hokkaido and is found to work very well.

The following is a list of particulars of the above-mentioned ropeway as set up at Yubari No. 1 :—

1. Length	...	...	...	...	...	6,500 metres
2. Difference between the levels of the terminals	...	...	...	...	...	91 metres
3. Difference between the highest and lowest points on the line	...	...	...	...	...	443 metres
4. Carrying capacity per 10-hour day—						
Ascending load	...	...	...	...	...	500 tons coal
Descending load	...	...	...	...	...	100 tons timber
5. Maximum weight of freight unit	...	...	...	...	...	Coal, $\frac{3}{4}$ ton
Maximum size of freight unit	...	...	...	...	...	Timber, 3 metres
When two cars are coupled, timbers	20					
metres long may be carried						
6. Distance between consecutive cars	...	...	...	...	...	82 metres
7. Speed, per minute	...	...	...	...	...	109 metres
8. Motive power required, electric	...	...	...	...	...	200 horse-power
9. Size of ropes—						
Track rope	...	...	...	...	...	41·5 mm.
Diameter at loaded line	...	...	...	...	...	35 mm.
Diameter at empty line, hauling rope	...	...	...	...	...	28 mm.
10. Number of supports	...	...	...	...	...	51
11. Maximum span between supports	...	...	...	...	...	337 metres

Table 7.—HAULING and Winding Engines in Use at the Seven most Important Collieries.

Mine.	Number.	Motive Power.	Horse-power.	Total Horse-power.
Sorachi	1	Steam ...	300	730
	1	" ...	50	
	2	" ...	40	
	2	" ...	30	
	1	Electric ...	180	
	1	" ...	50	
	1	" ...	10	
Poronai	1	Steam ...	300	460
	2	Electric ...	80	
Ikushunbetsu	2	Steam ...	20	40
Yubari No. 1	1	" ...	300	1,220
	1	" ...	200	
	3	" ...	50	
	2	" ...	30	
	1	Electric ...	135	
	6	" ...	50	
	1	" ...	30	
Yubari No. 2	3	" ...	15	200
	4	" ...	50	
Shinyubari	1	Steam ...	150	150

Drainage.—Fortunately water in the mines is comparatively scarce, and as much of the mining is carried on above drainage level wherever possible the water collected is drained naturally out of the mines. Water below drainage level has to be pumped to the surface either by compressed air or steam power.

When water is required to be pumped from a great depth the method is to construct receiving chambers at intervals of 200 feet one above the other and to raise the water by stages to the surface by separate pumps placed at these intervals. The mines are well supplied with pumps in spite of the scarcity of water, but about one-third are spare.

Table 8.—DETAILS of Pumps in Use at the Seven Principal Mines
(Issued by the Mining Companies).

Mine.	Number of Pumps.	Type.	Steam Cylinder Diameter.	Plunger Diameter.	Motive Power.
			Inches.	Inches.	
Sorachi ...	3	Worthington ...	22	7	Steam
	1	" ...	16	8	"
	2	" ...	13	5	"
Poronai ...	1	Turbine ...	...	6	"
	2	Knowles' special duplex	16	7	"
	1	Snow ...	9	4	Compressed air
	1	Dean ...	10	5	" "
Yubari No. 1	1	Worthington ...	8	4	" "
	4	Evan's Cornish...	18	12	" "
	3	Knowles' special duplex	16	7	" "
	3	Dean sinking ...	24	10	Steam
	1	Worthington ...	16	8	"
	1	Sinking ...	10	5	"
Yubari No. 2	1	Turbine ...	...	12	"
	1	Worthington ...	16	8	"
Shinyubari ...	2	Evan's ...	20 h.p., gallons per hour	5,100	"

Ventilation.—The majority of the mines are exceedingly fiery, and special attention has to be paid to ventilation. The main source of ventilation is produced by large 18 to 20-foot Guibal fans, but the largest fan in use is a 35-foot Waddle at Sorachi. These large fans are driven by steam. Auxiliary ventilation is obtained by Champion fans of from 4 to 8 feet in diameter, driven by direct current motor or induction motor. The Champion ventilators can be used both for exhausting or for blowing without changing the revolutions of the shaft. This device is especially useful for changing the direction of the air current in the mine in case of accident. In addition to these fans there are also provided underground a good number of small Eisen Keis and 4-foot Champion ventilators ready to be driven by compressed air in case of emergency. In the smaller collieries of the island ventilation is entirely natural.

As already mentioned in another paragraph, ventilation is regulated by partitions erected at intervals across the roadways. By this means the air currents are turned in the direction required and even the most remote galleries are reached. These partitions, furnished with self-closing doors, also divide the mine into ventilation districts, thereby confining the damage in case of explosion.

Table 9.—DETAILS of Fans in Use at the Seven Principal Mines.

Mine.	Number.	Type.	Diameter.	Motive Power.
			Feet.	
Sorachi ...	1	Waddle ...	35	Steam
	1	Guibal ...	20	"
	1	Champion ...	8	Electric
	4	Champion ...	6	"
	3	Champion ...	4	"
Poronai ...	1	Guibal ...	18	Steam
	3	Champion ...	8	Electric
	1	Champion ...	6	"
	1	Champion ...	4	"
Ikushunbetsu ...	1	Champion ...	6	Steam
Yubari No. 1 ...	2	Guibal ...	20	"
	7	Champion ...	8	Electric
	1	Champion ...	6	"
	1	Champion ...	4	Steam
Yubari No. 2 ...	5	Champion ...	4	Electric
Shinyubari ...	3	Cappel's mine fans	8	"
	1	Cappel's mine fans	4	"

Coal dressing.—Coal dressing is done either by manual or mechanical labour, the latter being now the more common, and in the largest mines adopted practically throughout. When done by manual labour the coal is classified into two kinds, "lump" and "small"; then from the lump slates and dirt are picked out by women, while the small is usually washed in a primitive trough in the following manner:—A wooden trough about 2 feet wide, 1 foot deep and between 40 to 50 feet long, set to an inclination of 10 degrees, is fed with small coal together with water at its upper end. The slate and dirt are deposited on the bottom, owing to their greater specific gravity, while the lighter coal is carried down with the water and collects on a platform placed at the lower end of the trough. From this platform it is loaded direct upon trucks. The deposited dirt is periodically removed from the trough, and either thrown away or used for banking up roads, &c., as convenient.

However, as mentioned above, the mechanical method is now generally prevalent. On leaving the mine the coal trucks are led along to the screening sheds, where they are dumped directly over bar screens set $\frac{1}{2}$ inch apart and placed at an inclination of 35 to 40 degrees. The coal which is too large to pass these bars is classified as "lump" and slides down to a platform, where the slate and dirt are picked out by women. This sorted coal is loaded direct on to trucks about 7 tons capacity. The coal which passes through the screens is treated in different ways at different mines. At some collieries it is made to fall into another set of screens $\frac{1}{4}$ -inch mesh, and the small coal under this screen is washed in wooden troughs in the method explained above, while the middle-sized coal, over $\frac{1}{4}$ -inch mesh, is washed by jiggars before being sent to the railway

Table 10.—DETAILS of Generating Plant in Use at the Seven Principal Mines.

Mine.	Steam (Boilers).			Compressed Air.		Electricity.		
			Horse-power.		Horse-power.		Kilowatts.	Volts.
Sorachi ...	9 Lancashire ...		100	1 compressed air engine ...	250	3 generators ...	60	550
	2 Babcock and Wilcox ...		70	...	...	2 " ...	250	3,300
	4 Heine safety ...		150	...	...	...	...	...
	2 vertical ...		36	...	...	...	...	...
	1 " ...		22	...	...	...	...	...
	2 auxiliary ...		36	...	...	...	...	...
Poronai...	10 Lancashire ...		135	1 compressed air engine ...	250	2 generators ...	270	550
	1 Cornish ...		50	...	...	...	...	...
	1 vertical ...		32	...	...	...	...	...
Yubari No. 1 ...	14 Lancashire ...		150	2 compressed air engines ...	640	3 generators ...	300	550
	6 Heine safety ...		200	1 " " " ...	480	2 " ...	250	125
	1 vertical ...		34	1 " " " ...	190	...	...	...
	2 " ...		30	...	...	...	...	...
Yubari No. 2 ...	4 Heine safety ...		150	...	...	2 generators ...	500	3,300
						2 Parson steam turbines, 50 h.p.		
Shinyubari ...	2 Babcock and Wilcox ...		70	1 compressed air engine ...	250	2 generators ...	150	2,200
	3 auxiliary ...		...	...	...	1 generator ...	75	550
Pompetsu ...	1 Cornish ...		20	...	...	...	...	...
	1 horizontal ...		30	...	...	...	...	...

Export of coal.—Practically all the coal produced in the Hokkaido mines is consumed in Japan, finding its way for the most part to Yokohama, Muroran, Otaru, Aomori and Hakodate, where it is used for coaling purposes. The amount exported does not reach 100,000 tons and is limited to the Yubari, Sorachi and Poronai mines. The chief ports of destination are Hong-Kong, Singapore, Vladivostok, San Francisco and Australian ports. The quantity exported during the years 1906–10 can be seen from the subjoined table :—

Mine.	1906.	1907.	1908.	1909.	1910.
	Tons.	Tons.	Tons.	Tons.	Tons.
Sorachi ... ..	...	...	6,600	500	...
Poronai ... ..	...	...	...	6,280	8,300
Yubari	24,304	54,926	44,821	16,970	66,382
Total	24,304	54,926	51,421	23,750	74,682

The mine owners of the Hokkaido cannot congratulate themselves on these figures, for even regarding them in the light of the ratio borne by the export to the net output, the result is considerably below that of the export from the rest of Japan to its total production. For while the production of Japan is about 15,000,000 tons, the export is nearly 3,000,000 tons or in the ratio of 5 to 1. The production of the Hokkaido is about 1,600,000 tons and the export at the most 75,000 tons, or in the proportion of 160 to 7 or more than 20 to 1. The companies concerned profess to believe that the quantity exported will increase, and doubtless such will be the case, at least to an extent in proportion to the increasing development of the mineral resources, but whether there will be a marked increase of export as compared with total production it is difficult to foresee.

Price of coal.—The price of the Hokkaido coal of course varies with the different mines and also with the demands of the coal market. The companies are, moreover, always open to make special terms to meet different cases, and thus there is no definite rate to quote. Taking, however, the grand total of annual receipts for all sizes and qualities of coals produced and sold at the four leading mines and comparing it with the gross number of tons sold per year, the following comparative table of average prices in yen per ton can be compiled :—

Year.	Yubari No. 1.	Yubari No. 2.	Sorachi.	Poronai.
	Yen.	Yen.	Yen.	Yen.
1906	6·906	6·726	6·061	6·397
1907	6·346	6·568	5·389	5·792
1908	6·045	5·984	4·651	5·174
1909	5·112	4·535	3·484	4·463
1910	4·705	4·651	3·730	4·365
Average	5·790*	5·480	4·473	5·188

* The average price in sterling works out at about 9s. 6d. to 11s. 6d. per ton. (583)

As is to be expected, in view of the superior quality of Yubari No. 1 coal, the average annual price of that coal is practically always higher than that of the coal produced from the other mines. There is little difference in the price of Yubari No. 1 and Yubari No. 2 coal, but that of Sorachi is much cheaper. It will be seen that the tendency is for the price to decrease. This is accounted for principally by the introduction of mechanical labour-saving improvements, but also owing to the increasing competition in the island.

The miner.—The position of the miner, his domestic, sanitary, medical and financial arrangements, are not without interest.

The following table (11) shows the number of miners employed in the Hokkaido in 1910 as compared with the preceding year. The figures for 1910 show a very considerable decrease, which is perhaps to be expected, in view of the necessity for curtailing the output in face of the previous year's excessive production, and also because of the gradual adoption of mechanical appliances.

TABLE 11.

Year.	Men.	Women.	Children.	Total.
1909	10,893	1,574	151	12,618
1910	8,494	1,474	56	10,024

The reduction in the number of children is proportionately the greatest, being for 1910 about one-third of the number employed in 1909. The figure is made up as follows :—

Poronai ...	22
Yubari No. 1	16
Yubari No. 2	9
Ikushunbetsu	5
Sorachi ...	4

They are mostly (47) employed in coal dressing, a few (8) come under the heading of "Miscellaneous" and 1 under "Engineering."

The following detailed table gives the number of workpeople employed at the seven principal collieries in 1910 and the various cities in which they work :—

TABLE 12.

Mine.	Miners.	Timbermen.	Dressers.		Carriers Underground.		Carriers Above-ground.		Artisans.	
			Men.	Women.	Men.	Women..	Men.	Women.	Underground.	Above-ground.
Sorachi ...	445	11	144	206	143	22	72	10	12	40
Poronai ...	588	40	69	146	155	...	53	...	9	42
Ikushunbetsu ...	272	12	106	81	60	...	...	...	1	10
Yubari No. 1 ...	1,129	69	417	627	965	...	111	...	...	72
Yubari No. 2 ...	275	21	52	64	97	...	113	...	...	40
Shinyubari ...	269	20	14	24	65	...	17	...	25	43
Pompetsu ...	340	10	...	40	60	...	20	...	40	18

Mine.	Mechanics.		Miscellaneous Underground.		Miscellaneous Above-ground.		Total.		Grand Total.
	Underground.	Above-ground.	Men.	Women.	Men.	Women.	Men.	Women.	
Sorachi ...	...	150	49	2	152	38	1,218	278	1,496
Poronai ...	...	71	181	...	120	51	1,328	197	1,525
Ikushunbetsu ...	...	15	55	...	34	11	565	92	657
Yubari No. 1 ...	60	110	184	73	328	64	3,445	764	4,209
Yubari No. 2 ...	...	32	41	...	41	15	712	79	791
Shinyubari ...	8	23	56	...	51	...	581	24	605
Pompetsu ...	...	3	40	...	114	...	645	40	685
Total ...	...	...	...	...	...	...	8,494	1,474	9,968

It will be seen that the totals for the men and women employed at the seven principal mines are identical with those of the whole of the Hokkaido. This is due to the fact that the totals for the seven principal mines have, for 1910, been taken by the authorities as sufficiently indicative of the actual number of persons employed in the mining industry of the island, without counting those employed in the remaining minor collieries. According to statistics for the preceding year (1909) the figures for the whole of the Hokkaido compared with those for the seven above-mentioned mines showed a difference of less than 200, so that it may be assumed that there are not more than about 200 persons employed in the Hokkaido collieries who are not included in Table 12.

It will be noted that women are employed both above and below ground as miscellaneous workers and carriers at three of the mines (Poronai, Ikushunbetsu and Yubari No. 1), and as coal dressers at all of them. The restriction of the female labour to these tasks is in contrast to the system prevailing in Kyushu and other parts of Japan where women are employed in the actual coal-getting, the management maintaining that the best results are obtained from those galleries where the two sexes work side by side. The absence of the system in the Hokkaido is voluntary and is regarded by some as the forerunner of a general legal prohibition.

From the accompanying table (13), giving the daily average wage of the various employés, the Hokkaido miner seems strikingly cheap compared with rates in other countries, working out at about 1s. 9½d. (0·88 yen) per day. It should be borne in mind, however, that the cost of living in Japan is infinitely cheaper than that of any European country, a Japanese being able to subsist on a few sen per day expended on rice. Indeed, the rate paid in the Hokkaido is high when compared with that which is usually paid in other parts of Japan. The average for Japan is 0·72 yen (1s. 5½d.), or 4d. per day less than that paid in the Hokkaido. In the preceding year (1909) the difference in the wages paid to miners in the Hokkaido and the rest of Japan was even greater, the Hokkaido miner receiving on an average 1·03 yen as against 0·75 yen for the rest of Japan, or as much as 6¾d. per day more than the rate elsewhere. The reduction of this difference in 1910 to 4d. per day as shown above is evidence that the wages paid in the Hokkaido are gradually coming into line with those prevailing in the rest of Japan, and it will not be long before they average the same. The reason for the present high rate of wages in the Hokkaido is due to the fact that labour is scarce in this newly-developed island, but as immigration and development increase the supply of labour will become easier and wages correspondingly drop. That this will be the case is already foreshadowed by the decrease in average wages to be noted in 1910 in practically every occupation connected with the mining industry. The greatest reduction is under the "Miners" column, followed by "Timbermen" and "Carriers, men and women." Under "Dressers," "Mechanics" and "Others" the reduction is only a few sen, but still a reduction.

Table 13.—DAILY Average Wages in Yen of Persons Employed at the Seven Principal Coal Mines in 1910.

Minc.	Miners.	Timbermen.	Dressers.			Carriers.		Carpenters.	Mechanics.		Others.		
			Men.	Women.	Children.	Men.	Women.		Men.	Children.	Men.	Women.	Children.
	Yen.	Yen.	Yen.	Yen.	Yen.	Yen.	Yen.	Yen.	Yen.	Yen.	Yen.	Yen.	Yen.
Sorachi ...	0·85	0·86	0·39	0·22	0·17	0·63	0·35	0·64	0·46	0·15	0·43	0·28	...
Poronai ...	0·93	1·17	0·38	0·21	0·19	0·59	...	0·59	0·47	...	0·57	0·23	0·19
Ikushunbetsu ...	1	1·09	0·43	0·26	0·19	0·62	...	0·56	0·42	...	0·57	0·25	0·22
Yubari No. 1 ...	0·92	1·21	0·43	0·25	0·19	0·72	...	0·63	0·45	...	0·50	0·23	...
Yubari No. 2 ...	0·97	1·28	0·42	0·23	0·19	0·67	...	0·61	0·53	...	0·45	0·27	0·25
Shinyubari ...	0·85	1	0·50	0·25	...	0·72	...	0·72	0·52	...	0·40	...	...
Pompetsu ...	0·67	0·72	...	0·23	...	0·60	...	0·60	0·53	...	0·38	...	...
Average ...	0·88	1·05	0·43	0·24	0·19	0·65	0·35	0·62	0·48	0·15	0·45	0·25	0·22
„ in 1909 ...	1·03	1·17	0·44	0·25	0·20	0·71	0·45	0·68	...	0·17	0·47	0·29	0·22

APPENDIX.

Yubari No. 1.—Discovered in 1888 but not opened till 1892, the mine subsequently in 1903 acquired the adjacent Manji mine, which is now incorporated in the whole. The total area of the concession is about 9,000 acres. Of workable seams there are two, the upper 24 feet thick and the lower 4 feet, lying between tertiary shale and sandstone. The quality of the coal is superior to any in the island—indeed, to any in Japan—and has gained for the products of this mine an excellent reputation. The two leading Japanese mail steamship companies—the Nippon Yusen Kwaisha and the Toyo Kisen Kaisha—as well as many foreign lines, the Imperial Naval Department and many foreign ships of war in the East make constant use of this coal.

The chemical analysis it will be remembered from Table 2 was as follows :—

Specific Gravity.	Moisture.	Volatile Matter.	Fixed Carbon.	Ash.	Sulphur.
1.223	1.120	46.588	49.585	2.440	0.267

The method of mining employed here is the combination of board and pillar system with long wall. There are five entry levels and three slopes from 1,000 to 2,000 feet ; in addition there is one shaft 550 feet. Levels, slopes and main roads are all laid out with double track 12-lb. rails. Haulage underground is usually by horse, though sometimes by hand. Compressed air locomotives (four in number) are used to bring trainloads to the surface in one case, otherwise hauling or winding engines are employed, of which there are three main machines—one direct steam hauling engine 300 horse-power and two endless rope hauling machines, one of 200 horse-power steam and the other of 135 horse-power electric induction motor. Coal from the newly acquired Manji mine is transported to Yubari No. 1 by the patent Tamamura system double ropeway, particulars of which are given at the end of the section on hauling. Pumping is done mainly by compressed air, 13 pumps (many spare) being all that are required as the mine is very dry. On the other hand it is very fiery, and two 20 feet Guibal's fans and 10 Champion's fans from 4 to 8 feet are used for ventilation, being driven, the larger by steam the smaller usually by induction motor. For safety, benzine safety lamps of German make are universally used. Coal dressing is practically all mechanical. The coal is classified into lump and small by screening. From the lump the dirt and slates are removed by women, while the small is classified in trommels and washed in jiggers. The motive power required in the mine is obtained from 14 24 feet long by 6 feet 6 inches diameter 150 horse-power Lancashire boilers (80 lbs. working pressure), and 6 200 commercial horse-power Heine safety boilers (working pressure 125 lbs.), besides

3 auxiliary boilers. In addition there are 4 air compressors and 3 300-kilowatt 550-volt 3-phase 50-cycle engine-type generators driven by horizontal condensing engines. The number of workmen employed is over 5,000 and the output about 500,000 tons, valued at 200,000*l.* to 300,000*l.* annually.

This colliery is the only one in which coal mining is carried on on anything approaching a large scale, or in which scientific methods have to any extent displaced the cumbersome means so largely employed throughout the Hokkaido. This is partly due to the fact that it is owned by an enterprising and wealthy company with capital sufficient to incur those initial disbursements for modern plant and improvements which are beyond the means of its humbler competitors. It is true that Sorachi, Poronai and Ikushunbetsu and Yubari No. 2 though owned by the same company are in no way in such a flourishing condition as Yubari No. 1. The reason is that financial considerations do not permit of a uniform development at all the mines, and the resources at hand have been wisely applied to developing the mine whose coal is the best quality and which exists in the largest quantities. Hence this mine is now in a class apart, and in any comparison with the other mines is found to be immeasurably superior.

Sorachi.—Discovered as early as the year 1854 but not officially surveyed until 1876, this mine was opened in 1891, when the railway from Otaru was completed. The concession, over 5,000 acres in extent, contains 10 workable seams varying in thickness from 2½ to 9 feet and occurring in tertiary shale and sandstone formation. The district is remarkably disturbed, the dip varying from 5 to 80 degrees, while in some cases it is actually vertical. Owing to this disturbance, resulting in numerous faults, the precise number of seams was for a long time doubtful. The quality of the coal, though not so good as that of the Yubari products, is sound and uniform, and renders the mineral particularly suitable for steam purposes. The method of mining is the long wall system where the dip is slow, and overhand sloping, as in metalliferous mines, when the dip is steep. The slopes and roadways are here, as at Yubari, laid out with double tracks of 12-lb. rails, which also connect the mine with the screening sheds. Haulage below ground is done by hand and horse. Above ground there are electric locomotives (5 in number) of 16 horse-power, driven by direct current motors, and 2 systems of the Tamamura single ropeway for coal transport from the outlying levels to the screening house; in addition, 2 direct winding engines, one of 300 horse-power steam and the other of 182 horse-power induction motor, besides auxiliary machinery. Pumping is done by 7 pumps, steam and electric, and wherever practicable water is drained naturally out of the mine by a ditch dug along the level. The mine is very fiery and safety lamps are used. For ventilation there are in use 1 35-foot Waddle and 1 20-foot Guibal fan, both driven by steam, and 8 Champion's fans of from 4 to 8 feet, driven by direct current motor or induction motor of from 10 to 50 horse-power. Coal dressing is similar to that at Yubari No. 1. The motive power required for the working of the mine is obtained from 9 100 horse-power, 24 feet long by 6 feet 6 inches diameter, Lancashire boilers

(working pressure 80 lbs.), 2 70 horse-power Babcock and Wilcox boilers with the same working pressure, and 4 120 lbs. pressure Heine safety boilers of 150 horse-power, 1 compressed air engine and 3 60-kilowatt 550-volt direct-current 4-pole 1,040 revolutions per minute compound wound generators, and 2 250-kilowatt 3,300-volt 3-phase 50-cycle engine-type generators, all driven by horizontal non-condensing engines. In addition there are 2 500-kilowatt 3,300-volt 3-phase 50-cycle turbo generators shortly to be installed. The number of workmen employed is about 2,000 and the output 250,000 tons, valued at 100,000*l.*, per annum.

Other mines.—The working and appliances at the other mines mentioned are practically the same as at Yubari No. 1 and Sorachi, only on a smaller scale. Details of their output, plant, &c., are given in the tables. Poronai ranks next in order of coal production and value, but Yubari No. 2 and Shinyubari come very close. These two latter mines have the advantage of being in their infancy, being opened in 1905 and 1906 respectively. They are well managed pushing concerns, and will doubtless come to the fore and surpass some of the older mines in the near future.

Mining rights.—The usual procedure adopted by persons or companies wishing to commence mining operations is to apply to the authorities for a licence to mine experimentally. Having obtained this permission they can set to work on the area specified in the licence. Licences are charged a fee of 40 sen per 1,000 tsubo (4 sen equal 1*d.* and 1 tsubo equals 3·593 square yards) and are good for two years from the date of issue, and though they cannot exceed this limit they may be surrendered at any time in the event of unfavourable results. If during this period, however, there are prospects of a successful enterprise the experimental licence can be changed for one of regular mining, the tax for which is 60 sen per 1,000 tsubo. When production has commenced a super tax of 1 per cent. is levied thereon. Armed with a licence either for experimental or regular mining the holder can override all objections to prospecting which the owner of the land may raise, though the latter is entitled to compensation for loss incurred.

The number of licences taken out in 1908 for coal mining were as follows :—

Experimental ...	266
Regular ...	8
Total	<hr/> 274 <hr/>

In that year 216,227,200 out of a total of 362,071,848 tsubo were prospected for coal alone, a figure which is indicative of the interest taken by prospectors in the coal-yielding possibilities of the island at that time.

Coke.—The coke plant of Oiwake is of interest as being connected with the coal mines of the island. Oiwake is 62 miles from Muroran, 27 miles from Yubari, the nearest colliery. It was opened in 1901 by the Hokkaido Tanko Kisen Kwaisha, the present owners.

A glance at the following table will show the output for the last five years (1906-10) :—

	Tons.
1906 ...	14,836
1907 ...	15,886
1908 ...	8,811
1909 ...	17,913
1910 ...	11,330

The coke produced is very well suited for blast furnaces and foundries on account of the small percentage of sulphur, as the subsequent analytical table will show :—

Specific gravity	1.63
Moisture ...	0.71
Volatile matter	1.01
Fixed carbon	86.60
Ash ...	11.58
Sulphur ...	0.07

The coal used to obtain these results is Sorachi and Yubari, for the reason that the Sorachi coal is remarkably soft and uniform in quality, while Yubari has an extremely low percentage of sulphur. The chemical analysis of these coals was, it will be remembered, as follows :—

Mine.	Specific Gravity.	Moisture.	Volatile.	Fixed Carbon.	Ash.	Sulphur.
Sorachi	1.267	0.890	32.368	59.826	6.740	0.176
Yubari ...	1.223	1.120	46.588	49.585	2.440	0.267

The plant consists of 50 Coppee pattern ovens, 27 feet long, 5 feet high and 3 to 4 feet broad, built in a single row. They are fed at the top by two charging holes each, and hold an average charge of 4 to 5 tons. In addition there are the washing plant, consisting of Elliot washers, jiggers, bucket elevators and disintegrators, boilers (two 24-foot Cornish), steam engines (two), and one steam-driven coke-pushing engine with a vertical boiler mounted on the same carriage, which runs on rails passing along the back of the row of ovens and serves them all.

Method of coking :—The coal to be treated is first washed and then allowed to fall together with water on to revolving screens of $\frac{1}{16}$ -inch mesh placed below. The fine coal passes under the screen and is led with water to setting tanks, whence it is conveyed to lorries of $\frac{1}{4}$ ton capacity for use in the ovens. The coal not passing through the revolving screens is fed into disintegrators, from which it is loaded into the above-mentioned lorries and conveyed along rails running over the ovens to the charging holes, where it is dumped into the ovens. After the ovens have been charged and the holes closed the next process is to level the coal in the oven by means of a long iron rod with a scraper, through the front and back doors of the oven.

The oven doors are now closed and plastered over with a luting made of loam mixed with fine sand. In 48 hours after the coal has been charged the firing is finished. The doors are then opened at the back and front and the pushing machine expels the coke on to the sorting platform, where it is cooled by sprinkling water on it. When the coke is thoroughly cooled it is loaded direct into railway wagons.

The yield of coke is between 60 to 70 per cent. of the coal after 48 hours firing. Hence with 50 ovens working at a charge of, say, 5 tons of coal, 250 tons in all, the yield ought to be between 150 to 175 tons per 48 hours. The number of workmen employed to produce this result is 150 to 160.

The price of coke.—This can best be judged from the following table giving the number of tons sold during the years 1906–10 and the value of the receipts obtained. It will be observed that the tendency is for the price per ton to decrease, as was the case with coal in general (see the table attached to section on the price of coal and following remarks).

STATISTICS of Coke Production and Value during the Years 1906–10.

Years.		Tons Sold.	Sales Revenue.	Average Value.
			Yen.	Yen.
1906	...	16,676	221,753	13·298
1907	...	14,446	198,524	13·742
1908	...	10,477	125,988	12·025
1909	...	12,383	134,469	10·859
1910	...	16,991	188,617	11·101
Average for five years...		...	...	12·249

This average value for the years 1906–10 works out at about 12. 5s. per ton.

It may be mentioned that there is no export of coke to foreign countries ; indeed, the great part is consumed in the Hokkaido in local furnaces, principally at Muroran.

Muroran and Otaru.—The most important ports of export as well as coaling stations for Hokkaido coal are Muroran on the south coast, not far from Hakodate and facing the mainland of Japan, and Otaru on the west. Of these, Muroran, although a comparatively new town, is the more important, securing about twice the business of her rival, and has prospects of a prosperous future. They are both connected by rail with the leading Ishikari collieries, the distances to which can be seen from the following table :—

	Otaru.	Muroran.
	Miles.	Miles.
Sorachi ...	76	174
Poronai ...	54	95
Ikushunbetsu ...	57	97
Yubari No. 1 ...	97	89
Yubari No. 2 ...	90	83
Shinyubari ...	94	87
Pompetsu ...	59	99

It will be noted that Otaru is considerably nearer to the majority of collieries than Muroran, and this fact renders the latter's greater prosperity at first sight rather remarkable. It is in part explained, however, by the fact that Muroran is nearer to the Yubari No. 1, Yubari No. 2 and Shinyubari collieries—noted for the superior quality of their coal—and also because of her position as a port in regard to the mainland of Japan, whither the Hokkaido coal is mainly sold. Muroran is over a day's journey by boat nearer to Yokohama—the principal destination of Yubari coal—than Otaru. The quantity of coal kept in store at Muroran is about 100,000 tons; at Otaru it scarcely reaches half that amount.

Method of loading coal at Muroran and Otaru.—The method in practice at these ports is as follows:—Upon the arrival of a vessel requiring coal, the coal which is stacked on shore according to size, quality and colliery, is put into straw bags 2 feet high by 2 feet 3 inches wide, with a capacity of 150 lbs. of coal, and the bags are piled on lighters. Lighters are of two kinds, the larger loading 90 tons and the smaller 30 tons, the former being in more common use. When they are laden a tug draws them out to the vessel, which moors in calm water inside the harbour, and receives the coal. A kind of large rope basket, called a mokko, capable of containing 17 or 18 bags but usually taking 12 or 13, according to the lifting capacity of the ship's winch, is used for transferring the coal from the lighter to the vessel. By this means the quantity of coal loaded in a day sometimes exceeds 5,000 tons at Muroran. The number of stevedores, boatmen and others engaged in coaling is over 1,100 at Muroran. At Otaru the number is considerably less.

The fact that Muroran and Otaru rank respectively third and fourth on the list of Japanese ports in respect of size, has opened the eyes of the local authorities to possibilities, and has induced them and the companies interested to devise some more practicable means of coaling than the lighter system. Accordingly, raised wooden wharves or platforms have been and are being erected, furnished with double tracks of standard gauge rails, and with patent shoots into which coal can be discharged from railway trucks and shot direct into the ship's bunkers. As several vessels can lie up at once at these platforms the coaling is much accelerated and will be more so when the platforms now under construction at Otaru are completed.

Before the time when the Government took over the railways of the Hokkaido they were mostly owned by the collieries interested in the industry, in particular by the Hokkaido Tanko Kisen Kwaisha. It is still a sore point with these companies that the railways were compulsorily bought from them, and then the rate of freight from the mines to Otaru and Muroran placed at an exorbitantly high figure. The rate is about 3s. per ton for 100 miles, and although there was at one time considerable feeling and agitation in favour of lowering this charge, no success has as yet been met with.

Housing of miners.—The usual system under which the mining companies house their employes is for married miners to live in houses erected at the companies' expense, and either let to them or lent free of charge; while the single men live together in furnished

houses, the company boarding them and deducting the cost from their wages.

As regards married men's quarters, at Yubari No. 2 they are free, but with this exception—the rule is to charge a rent of 20 sen (about 5*d.*) per month for a house of 5 to 6 tsubo (1 tsubo equals 36 square feet) for the first three years of occupation, after which period the dwelling is free. All repairs are undertaken by the company.

The rate required of unmarried men is 8 yen per month for food and lodging. Account of all extras supplied is taken, such supplies not exceeding in value the amount of a month's wages. At the end of the month a deduction of extras is made from the wages due and the balance paid to the employé.

The supervision of the sanitary arrangements of these dwellings falls to a committee elected by the miners from their own number, the mining companies supplying the necessary outfit.

Insurance and prevention of accident.—In spite of every care accidents are not infrequent, the total number in 1909 being 424, the majority of which were due to falling rock or coal resulting from explosion or other cause. The number of persons affected was 465, made up as follows :—

Killed	19
Seriously injured	42
Slightly injured	404

To meet such emergencies, hospitals have been erected at all the large mines, and where there is no hospital there is always a competent medical officer attached to the concession.

In order to defray the expenses of medical assistance a fund is inaugurated to which miners contribute about 15 sen per month (about 4*d.*). It is usual for the mining company to add to this fund the same amount as that subscribed by the miners, but where the combined sum is not sufficient the company from time to time makes up the deficit. That the companies bear the burden of medical expenses will be seen from the following table. Out of a total of 92,015 yen for such expenses the miners contributed 25,523 in 1909 or less than one-third. Reckoning about 12,000 to 13,000 miners in that year in the Hokkaido, the amount of each person's subscription works out at about 2 yen (or 4*s.* 1*d.*) for the year.

TABLE showing Respective Contributions during 1909 of Mining Companies and Miners' Societies towards Miners' Accident Compensation Fund.

	Mining Companies. Yen.	Miners' Societies. Yen.
Medical treatment	33,705	14,256
Compensation (temporary illness) ...	25,227	9,074
Funeral expenses	478	408
Compensation (to relatives)	3,168	70
Compensation (permanently disabled)	3,912	1,714
Total ...	66,492	25,523
Grand total ...	...	92,015

The money subscribed is devoted to defraying hospital, medical and funeral expenses, and to providing compensation to the miner in the event of illness or disablement, or to his relatives in the case of death. A table showing the value of these expenses and compensations is attached. It is interesting to see that the compensation allowed during temporary illness (0·89 yen per day) is only 14 sen (or $3\frac{1}{2}d.$) less than the average daily wage, 1·03 yen (or $2s. 1\frac{1}{2}d.$), taking 1909 figures, while the compensation in the event of total disablement is only 98·19 yen (or about 10%).

RESPECTIVE Contributions towards the Average Sum Allowed to
a Miner in Case of Accident, Illness or Death.

	Mining Company.	Miners' Societies.	Total.
	Yen.	Yen.	Yen.
Medical treatment	0·33*	0·10*	0·43*
Compensation during illness	0·72*	0·17*	0·89*
Funeral expenses	11·96	5·80	17·76
Compensation (to relatives)	79·20	7·77	86·97
Compensation (disabled miner)	68·64	29·55	98·19

* Denotes allowances per day ; the remainder are lump sum contributions.

In order to induce the miners to save money from their wages, mining companies institute a savings fund, contributions to which are voluntary and compulsory. A miner under contract for a fixed period of years comes under the compulsory system, the remainder subscribe voluntarily. The interest on the former savings is, of course, higher than that on the latter, being 20 per cent., while the rate on voluntary investments is 10 to 15 per cent., according to the period. In the minor collieries the voluntary system alone prevails, the interest allowed being 5 to 7 per cent. per annum.

As an encouragement to their employés, the leading mining companies institute a system of gratuities, distributed annually. The usual method of raising the wages by periodical increases is not much favoured, though adopted by a few companies. In addition to a yearly gratuity a memento is presented every five years up to the end of the fifteenth year, consisting of a silver cup on that occasion for long service and an inducement to continue in employment.

Education in the mines.—The education of miners' children was formerly undertaken by the mining companies, who built schools and provided the educational staff. These schools were subsequently taken over by the local authorities who now control the instruction. Technical as well as ordinary subjects are taught, the assistance of mining companies' officials being enlisted for the technical branch alone. The result of this system is claimed to be very successful, many children passing from the schools into the offices and workshops of the companies.

The Hokkaido Tanko Kisen Kabushiki Kwaisha.—So closely is the history of this company associated with that of the coal mining industry of the Hokkaido that it will be well to give a few details of its formation and development.

Founded in 1889 as a railway company with special privileges from the Government to own and operate coal mines, the Hokkaido Tanko Kisen Kwaisha started business with a capital of 6,500,000 yen, which was increased owing to the demands of its progressing business to 27,000,000 yen (4,500,000 yen still uncalled) in 1906, while debentures to the extent of 10,000,000 yen were issued and raised in London. About that time (1906) the Imperial Government adopted the policy of nationalising the principal railways of the country, and the company's lines came to be purchased at the price of 30,997,100 yen, paid in railway bonds, the Government at the same time taking over the company's loan to the extent of 4,000,000 yen. From this date the company ceased to be a railway company, and expended all its energy in enlarging its colliery works, shipping service, the manufacture of cokes and the forestry business, together with establishing an iron foundry; while in conjunction with two companies in the United Kingdom it opened a steel works in Muroran.

Although the products of the company's collieries barely exceed 1,000,000 tons annually, this figure represents two-thirds of the total output from the island. In fact, the company commands nearly all the coal mines, and virtually monopolising the ports of Otaru and Muroran, besides owning a fleet of steamers and conducting the business of shipping and coke manufacture, indisputably controls the coal business of the Hokkaido.

The mines owned by the company are Sorachi, Poronai, Ikushunbetsu, Yubari No. 1 and Yubari No. 2. These five collieries all rank in the list of seven most important mines taken by the authorities for statistical purposes. A glance at the names shows that the company owns both the oldest mine (Sorachi) as well as the largest, most productive and up-to-date (Yubari No. 1). The possession of the latter colliery alone would put the company at the head of the list. As it is, the Hokkaido Tanko Kisen Kwaisha is not only the premier producer of the Hokkaido, but is already one of the largest coal producers in the Orient.

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