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GEOLOGICAL BRANCH
ASSESSMENT REPORT

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THE INTERIM REPORT ON THE FIELD INVESTIGATION

EXECUTED IN

THE FLATHEAD RIDGE P.C.I. PROPERTY, B.C., CANADA

MARCH 1970

MITSUI MINING CO., LTD.

DEVELOPMENT DEPT.

I. INTRODUCTION

The geologic survey of the coal property south of Morrissey Creek in Crowsnest Coalfield, Province of British Columbia, Canada has been repeatedly executed jointly by Nittetsu Mining Co., Ltd. and Toyo Menka Kaisha, Ltd., and in 1968, a feasibility report was submitted by Nittetsu Mining Co., Ltd. However subsequently, Nittetsu Mining Co., Ltd. was forced to withdraw their hands from the property due to company circumstances.

Mitsui Mining Co., Ltd. from their individual standpoint; have obtained permission from Pacific Coal Limited, under the precondition that a decision shall be made as to whether or not minute and industrialization survey shall be made upon results of supplimentary investigation of the property, have executed the above supplimentary investigation in the three month period of June to August, 1969.

The survey was administered with stress on the clarification of the geologic structure and the result showed numerous differences in the distributive condition of coal seams, dip of seams, etc. with relation to the previous report. To prevent the duplication of reports, we have indicated the parts that differ from the previous report and added some of our interpretations.

III. DETAILS OF THE RESULT OF INVESTIGATION

1. Stratigraphy

The coal bearing formation that intercalates minable hard coking coal seams is the Kootenay coal bearing formation, late Jurassic to early Cretaceous in geologic age, of which the compiled standard columnar section is illustrated in fig. No. 3. The result of stratigraphic correlation based on the 1/200 scale columnar sections from all the trenches and drill-loggings were summarized in a plan with a scale of 1/1,000. The fig. No. 4 is the reduced plan from the 1/1,000 scale.

The result of the correlation differs from the Nittetsu report. The previous correlation lines are drawn in red in the plan, which reveals unreasonable effect when compared to our result.

2. Geologic Structure.

The geologic structure of the surveyed area is analyzed on the seam contour maps of 1/5,000 scale for the major workable coal seams which are drawn by using geologic cross sections of the same scale based on the surface and subsurface geologic data. For the unsurveyed area, geologic data from published references are adopted and compiled on 1/50,000 scale geologic map and geologic cross sections. The fig. No. 5 is the reduced map from the original 1/50,000 scale and the fig. No. 6 is the contour map of B-seam based on the compiled data from the 1/50,000 and the 1/5,000 geologic plan.

The result of the analyses of the geologic structure is summarized on the 1/5,000 scale geologic map and cross sections, which are reduced as shown in figs. No. 7 and No. 8. In fig. No. 8, the result of the previous Nittetsu study in the same position is indicated by overlapping line, which reveals unreasonable aspects to the surface and subsurface geologic data and the stratigraphic facts.

The significant geologic structural features in the plan are the NW-SE trend disturbance in the southwestern part and an undulated zone in the northern part running N-S trend split from the disturbance.

3. Coal Seams

Description of the coal seams in this paragraph is confined to the A seam and B seam that will be entitled as workable hard coking coal.

(a) Situation

The continuation of both coal seams is concluded to be as shown in fig. No. 9, based on the correlations among outcrop sections and between outcrop and drill sections. The result of this correlation differs from the previous Nittetsu result, especially in B seam as shown in fig. No. 10, which is a correlation revised by rearranging the previous Nittetsu data.

The situational conditions of both seams are graphically shown by taking their inclined area percentage at a certain classifications for inclination, overburden thickness, seam condition, and degree of exploration.

Their descriptions for each seam are as follows.

B seam: The continuation of this seam and the difference between this result and previous result have already been shown in the figs. No. 4 and No. 10. Thickness variation to the deeper part is predicted based on the correlation between outcrop section and drilled section. The correlation comes out as shown in fig. No. 11. Taking the results of these correlations together with the result of structual analysis, the area and percentage of the above mentioned classifications are measured and calculated on a plan with scale of 1/10,000. The classifications for each condition are as follows.

Overburden Thickness (vertical thickness between surface and coal seam)	More than 400 meters 400 - 200 meters Less than 200 meters
Inclination	More than 20° 20° - 15° Less than 15°
Seam Condition	Favorable (coal thickness of more than 2.5 meters) Unfavorable (coal thickness less than 2.5m) Split Unknown
Degree of Exploration	Proved area Unproved area Unstable area

The regional distribution of these classifications is shown in the reserve calculation plan (fig. No. 12) which is reduced from the original scale, and their frequency percentages to the total area are shown in the graphic expressions in fig. No. 13.

A seam: The same methods of correlation, analyses, and classifications are adopted for A seam, and the results are illustrated in figs. No. 9, No. 14, No. 15 and No. 16.

(b) Reserves.

The coal thickness required in calculating the coal reserves is analysed by trend surface analysis to extract a general tendency of regional variation for the area where the data are sparse. The coal thickness for each section of each of the individual classification is thus adopted for theoretical reserve calculation, excepting that in the unproved area, a thickness of 3.0 meters for each individual seam is presumed.

The theoretical reserves are calculated in each classifications of altitude (above 1,200m, 100m each), inclination, overburden thickness, seam condition, and degree of exploration, and given in the maps as shown in figs. No. 12 and No. 15. Safety factor is applied for the calculation in accordance with the length of distance from the observed point and by considering the geologic conditions. Yield factor in washery is presumed to be 70% for both seams. The summarized tonnage (metric) of the

RESERVES OF THE MAJOR SEAMS

Unit: 1,000 tons

		MITSUI			NITTETSU		
		Proved Area	Unproved Area	Total	Original		For Comparison with Mitsui
THEORETICAL	B	54,305	38,151	92,456	B upper	21,500	21,500
					B	46,500	46,500
					total	68,000	68,000
	A	70,550	34,890	105,440	A	62,200	62,200
					A	12,400	-
					A	11,200	-
					Total	85,800	62,200
Total		124,855	73,041	197,896		153,800	130,200
RECOVERABLE*	B	15,109	10,383	25,492	B upper	4,600	4,600
					B	19,400	19,400
					total	24,000	24,000
	A	13,759	8,162	21,921	A	9,500	9,500
					A	4,800	-
					total	14,300	9,500
Total		28,868	18,545	47,413		38,300	33,500

* Recoverable reserves are estimated on the suppositions that Mitsui applies room & pillar method while Nittetsu applies the longwall method.

two seams is tabulated in the attached table compared with the result of the previous Nittetsu report.

The amount of actual recoverable reserves depends on the mining method which has different recoverable percentages for different plans. At the present stage of exploration where only half of the object area is proven and the other half still remaining unproved or unknown, it is premature to calculate the actual recoverable reserves. We have made a tentative recoverable reserve calculation for A and B seams in the object area on the condition that room and pillar mining method by continuous miner is applied in the area where inclination is gentle so that operations at pitch angle of less than 7° is possible with seam thickness of more than 3.0 meters. Their tonnages come up to 25,492,000 tons for B seam and 21,921,000 tons for A seam, but the values will vary to some extent with the progress of exploration and examination.

(c) Quality

The quality essential for hard coking coal is characterised by rank (degree of coalification) and grade (degree of concentration of clean coal). These two factors have been analysed and dealt with in predicting the quality of production and the economic value of the coal in the objective area.

The summarized results are given in the folloling pages.

Rank (Degree of Coalification)

To analyse the rank variation of this area, an intimate relationship between the analitical values of coaly materials in the drill logs and their horizons is obtained. The general tendency of the two is illustrated in fig. No. 17. The Regression analysis dealing with the correlation between volatile matter (dry ash free basis) of coaly materials with ash contents of less than 20% and their accumulated interval thickness in each drill log reveals linear correlation with high probability as shown below.

Name of Drill Hole	Expression	N	S
J-5	V.M.(d.a.f.)=37.06-0.037X	11	-0.80
J-4	" =31.23-0.035X	5	-0.89
J-1	" =26.92-0.028X	6	-0.71
J-2	" =24.57-0.040X	3	-0.98
J-3	" =21.11-0.017X	5	-0.50

Where X is stratigraphic interval thickness from the uppermost seam, N is the number of data and S is the correlation coefficient.

Based on this fact, the rank indicated by volatile matter is considered to be controlled by initial depth of burial for coaly materials of this area. While on the other hand, in general, an initial burial depth of a plant debris in a coal basin is considered to be controlled originally by geologic movement of subsidence and the volume of covered sediments caused by the movement.

The general tendency in thickness variation of the Kootenay formation covering the Crowsnest coal basin has been studied by computer trend surface analysis adopting published data together with our measured data, and the result is quite useful in considering the general tendency of regional initial depth variation of major coal seams. On the other hand, the analitical data of fresh samples taken from the tunnels and drill holes put into A and B seams were dealt with by trend surface analysis in extracting the general tendency of regional volatile matter variation. The tendencies of both seams resemble each other, and are also similar to that of the thickness variation in the Kootenay formation. We are thus able to predict the rank variation covering the object area.

Rank and Coking Property

The data on the analyses and tests executed by Japanese steel mill laboratories on fresh samples taken from the tunnels in both seams are summarized in the attached tables.

Dealing with these data, the correlation between drum-index and volatile matter (d.a.f.) is graphically analyzed as shown in fig. No. 18. It is evident from this figure that there is a close relationship between rank indicated by volatile matter and the coking property indicated by drum-index, and it is also evident that

PROXIMATE ANALYSES & COKING T[illegible]

A SEAM WASHED COAL SA[illegible]S

TUNNEL SAMPLES	LAB.*	MOIST.	ASH	V.M.	F.C.	T.S.	KCAL/KG.	F.S.I.	P	D.I. +15mm	D.I. Blended with domestic coal +15mm
TA-1	Yw	1.4	4.6	21.0	73.0	0.41	8,150	7½	-	89.9	88.7 (Onoura 70%)
	Fj	1.4	4.7	21.8	72.0	0.40	8,060	6	0.068	92.1	90.6(Heiwa 35%, Mojiri 35%)
	Ka	1.0	4.3	21.6	73.1	0.38	8,230	6	0.070	92.1	91.0 (Yubari 70%)
	Sm	1.5	4.6	20.8	73.1	0.42	-	6½	-	93.1	91.6 (Akabira 60%) 91.0 (Akabira 70%)
	Ko	1.49	4.15	20.75	73.6	0.42	8,322	7	0.088	94.4	92.9 (Takashima 70%) 92.8 (Toyosato 70%)
	NKK	1.0	4.8	21.3	72.9	0.40	8,130	6½	0.822	90.0	89.5 (Oyubari 60%) 89.1 (Oyubari 70%)
TA-3	Fj	1.4	6.4	20.9	71.3	0.27	7,920	3½	0.029	50.0	91.5 (Heiwa 5%, Mojiri 50%)
	Ka	0.8	6.6	19.5	73.1	0.27	7,900	4	-	60.1	92.8 (Yutoku 70%)
	NKK	-	6.6	19.5	73.9	0.29	8,230	3½	0.76	63.9	87.7 (Oyubari 70%)
TA-4 Upper	Yw	1.4	6.5	17.2	74.9	0.44	7,970	3½	-	70.2	87.7 (Onoura 70%)
	Fj	1.2	6.4	17.4	75.0	0.50	7,990	3	-	50.3	90.0 (Heiwa 35%, Mojiri 35%)
	Ka	0.8	6.8	17.7	74.7	0.45	7,970	3	-	39.7	93.6 (Yutoku 70%)
	Sm	1.6	6.6	17.4	74.4	0.44	-	4½	-	36.0	93.0 (Akabira 60%) 92.0 (Akabira 70%)
	NKK	0.9	6.6	17.5	75.0	0.41	7,930	4	-	-	91.6 (Oyubari 60%) 90.1 (Oyubari 70%)
TA-4 Lower	Yw	1.4	6.3	17.5	74.9	0.34	8,020	3½	-	-	84.0 (Onoura 70%)
	Fj	1.3	6.0	17.6	75.1	0.40	8,010	3	-	44.2	91.2 (Heiwa 35%, Mojiri 35%)
	NKK	0.8	5.1	17.4	76.7	0.34	8,050	4½	-	-	92.0 (Oyubari 60%) 89.1 (Oyubari 70%)

*Note: Yw = Yawata Iron & Steel Co., Ltd.; Fj = Fuji Iron & Steel Co., Ltd.; Ka = Kawasaki Steel Corporation
Sm = Sumitomo Metal Industries Ltd.; Ko = Kobe Steel Ltd.; NKK = Nippon Kokan Kabushiki Kaisha.

PROXIMATE ANALYSES & COKING TEST RESULTS BY STEEL MILLS

B SEAM WASHED COAL SAMPLES

TUNNEL SAMPLES	LAB.*	MOIST.	ASH.	V.M.	F.C.	T.S.	KCAL/KG.	F.S.I.	P	D.I. +15mm	D.I. Blended with domestic coal +15mm
TB-6	Yw	1.8	6.8	23.2	68.2	0.44	7,900	8½	0.078	94.6	89.8 (Onoura 70%)
	Fj	1.8	6.7	23.1	68.4	0.49	-	7½	0.069	93.1	91.9 (Hokkaido 70%)
	Ka	1.7	6.8	23.7	67.8	0.45	8,070	8½	-	93.0	91.6 (Yutoku 70%)
	Sm	1.9	7.2	22.3	68.6	0.56	-	7½	-	93.5	91.8 (Akabira 60%)
	Ko	-	6.73	24.06	69.21	0.46	-	7½	-	95.4	91.8 (Takashima 70%)
	NKK (SG=1.95)	-	18.3	21.1	-	-	7,540	9	0.10	-	-
	NKK (SG=1.34)	-	3.8	24.2	-	-	8,610	9	-	-	-
TB-5	Yw	1.2	6.1	21.1	71.6	0.50	8,030	9	-	94.8	91.6 (Onoura 70%)
	Fj	1.2	6.2	20.9	71.7	0.53	7,990	9	0.101	93.5	90.8 (Hokkaido 70%)
	Ka	1.2	6.3	21.2	71.3	0.49	8,140	8	-	94.3	92.7 (Yutoku 70%)
	Sm	1.7	6.1	20.1	72.1	0.48	-	9	-	93.5	92.1 (Akabira 60%)
	Ko	-	6.73	21.71	72.09	0.51	-	8	-	-	- -
	NKK (SG=1.4)	0.4	6.75	20.74	72.11	-	8,150	8½	-	-	-
	NKK (SG=1.6)	0.4	12.22	19.91	67.47	-	7,570	-	-	-	-
TB-4	Yw	1.1	6.8	22.1	70.0	0.42	8,030	9	-	94.8	93.3 (Onoura 70%)
	Fj	1.2	6.8	22.0	70.0	0.42	7,930	8½	0.077	93.3	90.7 (Hokkaido 70%)
	Ka	1.2	6.9	21.3	70.5	0.38	8,080	9	-	94.4	92.5 (Yutoku 70%)
	Sm	1.5	6.6	21.4	70.5	0.39	-	8	-	94.0	93.7 (Akabira 60%)
	Ko	-	6.81	22.8	70.39	0.39	-	9	-	94.9	91.9 (Takashima 70%)
	NKK (SG=1.4)	0.38	6.80	21.86	70.96	-	8,130	-	-	-	-
	NKK (SG=1.6)	0.44	10.38	21.38	69.80	-	7,770	-	-	-	-
TB-3	Yw	1.3	6.0	20.8	71.9	0.52	8,060	7½	0.120	94.4	80.1 (Onoura 70%)
	Fj	1.4	6.2	20.6	71.8	0.52	7,950	7	0.119	93.8	90.8 (Hokkaido 70%)
	Ka	1.5	6.4	20.5	71.6	0.49	8,220	8	-	93.4	93.0 (Yubari 70%)
	Sm	1.7	6.2	20.2	71.9	0.49	-	7½	-	94.3	93.8 (Akabira 60%)
	Ko	-	6.35	20.91	72.74	0.50	-	7½	-	-	-
	NKK (SG=1.4)	0.42	4.88	21.10	73.60	-	8,280	-	-	-	-
	NKK (SG=1.6)	0.42	7.53	20.16	71.89	-	8,040	-	-	-	-
TB-2	Yw	1.2	6.6	20.1	72.1	0.57	-	7½	-	94.7	90.5 (Onoura 70%)
	Fj	1.2	6.4	19.3	73.1	0.60	7,980	6½	0.150	92.6	91.6 (Hokkaido 70%)
	Fj	1.2	7.9	19.0	71.9	0.60	7,890	6½	0.135	92.5	91.7 (Hokkaido 70%)
	Ka	1.1	6.9	19.1	72.9	0.56	8,010	7½	-	91.4	92.8 (Yutoku 70%)
	Sm	1.4	7.0	18.4	73.2	0.55	-	7	-	93.2	93.1 (Akabira 60%)
	NKK	0.6	7.0	19.2	73.2	0.54	8,090	7½	0.177	92.1	89.6 (Oyubari 70%)
	NKK (SG=1.4)	0.4	4.56	19.34	75.70	-	8,280	-	-	-	-
	NKK (SG=1.4 ~1.6)	0.4	21.76	17.44	60.40	-	6,420	-	-	-	-

Note: Yw = Yawata Iron & Steel Co., Ltd.; Fj = Fuji Iron & Steel Co., Ltd.; Ka = Kawasaki Steel Corporation; Sm = Sumitomo Metal Industries Ltd.; Ko = Kobe Steel Ltd.; NKK = Nippon Kokan Kabushiki Kaisha.

coal from within this area, in attaining a coke with drum-index of more than 90, should have volatile matter of more than 20%.

The samples used for the above mentioned tests and analyses in steel mill's laboratories were washed and prepared with ash content at less than 7%. As coal petrologic and ash content variations affect the coking property of a coal in general, a graphic correlation analysis is executed by adopting the volatile matter, swelling index and ash content values of the 134 piece samples of previous Nittetsu report respectively as rank index, coking property and inert index, of which results are illustrated in fig. No. 19.

The [illegible] experiments, such as fluidity tests, [illegible] the area and with other coal by utilizing microscopic reflectance observations are now being carried out to realize the coking property. The prediction of regional variation in coking property covering the object area becomes available considering the regional variation of rank of the coal.

Grade (Degree of Concentration of Clean Coal)

Float and sink tests were made at our laboratory on the tunnel samples and in order to variously study the expected actual yield rates, the following assumptions are made.

(i) Basis of Calculation.

In order to study the B seam which is considered to become the object of mining, the results of the float and sink tests on the 4 samples of TB-2, 3, 4 and 6 are compounded on a arithmetical mean. (Refer to figs. No. 20 & No. 21).

The ratio of over and under size separated at 0.5mm and the ash percentage has been assumed from result of tests.

Size (mm)	Wt (%)	Ash (%)
50 - 0.5	80.0	23.5
0.5 - 0	20.0	22.1
Total	100.0	23.2

The yield has been calculated with the assumption that the +0.5mm raw coal shall be washed with heavy medium cyclone and the -0.5mm fine coal by froth floatation in order to produce low ash [illegible] and also to improve the yield by promoting the wash- ing efficacy.

(ii) The Expected Washing Results.

The washing yield in the case of H.M. Washer [illegible] computed with a probable error (EP) of [illegible] in the case of floatation, it is obtained throu the ash balance. These two values are compour to obtain the yield of the total raw coal.

Studies are made on the three occasions when the washing results respectively showed ash contents of 7.0, 8.0 and 9.0 percent.

Clean Coal Ash (%)	7.0	8.0	9.0
Raw Coal Ash (%)	23.2	23.2	23.2
Degree of Difficulty	11.8	8.0	5.6
Cut, Sp. Gr.	1.53	1.60	1.68
Probable Error	0.05	0.05	0.05
Efficiency (%)	98.5	99.5	99.6
Calculated Yield (%)	70.0	75.0	77.0

(iii) Yield Revision from Mining Technology

In actual mining, it would not go as smoothly as at the time of taking samples and the yield would fall due to dilution from hanging and foot walls and also from developments. Therefore, if the yield is revised with an allowance of 5% dilution from foreign materials, it will be as shown in the following table.

Clean Coal Ash (%)	Calculated Yield (%)	Revised Yield (%)
7.0	70	65
8.0	75	70
9.0	77	72

(iv) Comparison of Raw Coal Proceeds

Assuming the price index of clean coal with ash content of 7% is 100 F.O.R. mine, if a calculation of the raw coal proceeds is made with consideration of merits for ash, sulphur, yield, etc., it will become as follows, and it is believed that the most suitable case would be when the clean coal ash content is 8% and the yield rate is 70%.

Clean	Coal	Ash (%)	7.0	8.0	9.0
"	"	Sulphur (%)	0.5	0.5	0.5
"	"	FOR (index)	100.0	96.0	92.0
"	"	Yield (%)	65.0	70.0	72.0
Raw	"	FOR (index)	65.0	67.2	66.2

4 Mining Technological Factors

The geologic conditions from the mining technological point of view is as follows.

(a) Hanging Wall or Roof Condition

The roof conditions as observed at the outcrop could be classified into the following three types upon referring to the outcrop area observed.

Stratified Shale
Stratified Shale with Interposition of Coal Bands
Sandstone

However, judging from drilling data, the interposition of coal bands in the stratified shale becomes extinct as it goes deeper resulting in a better roof condition. As a whole, the roof is strong and with the exception of some parts, it could be judged that roof bolting method for support can be applied.

(b) Footwall or Floor Condition

The floor is of stratified shale and judging from the result of test on water imperviousness, it is unbelievable that water would be of great trouble.

(c) Hardness of Coal Seam

The hardness of the coal seam, as judged from the results of the Schmit Hammer test and the MTA-AH test, is about medium and therefore it is judged that the use of cutting machines are possible.

(d) Presence of Siliceous Rocks in Coal Seam

Small siliceous rocks are observed here and there in the vicinity of the outcrop but nothing is known of the deeper area.

(e) Ground Water

Nothing is known as to the volume of ground water that would be encountered during operation but consideration should be given to a reasonable amount during the snow thawing season.

(f) Gas Emission

Situation of gas emission is not known. It would be justifiable to consider that a certain amount of gas emission might occur in deeper area.

IV. CONCLUSION

A summarization of the field investigation and statement to some future potential problems have been made to arrive at a conclusion of the investigation result.

1. Summary of the Result.

   (a) The stratigraphic position of the coal bearing formation of this property belongs to the Kootenay formation, one of the major potential coal bearing formation in the Canadian Rocky Mountains. It has a thickness of 650 to 800 meters at the outcrop area, and intercalates major coal seams within the middle and lower horizons.

   (b) The geologic structure is rather simple comparing with other coal fields in the Rocky Mountains, forming a monoclinic structure in the southwestern flank of the MacEvoy syncline in the Crowsnest Coal Basin. The general strike of NW-SE in the property continues for about 8 kilometers, and the inclination is rather steep in the outcrop area (max. 25°), but decreases gradually toward its northeastern deeper part to a more gentle slope (less than 15°). The southwestern part of the outcrop area is affected by the structural disturbance with a NW-SE direction, part of which seems to diverge into the northern part forming a zone of undulation.

(c) The coal seams ~~entitled to be~~ indicated as workable hard coking coal are the B-seam and the A-seam, both of which situate in the middle horizon of the formation with an average interval thickness of 50 meters. The B-seam, or the upper one, is rather consistent in coal thickness which is between 2.5 meters and 4.0 meters with the exception of a small spot where a split occurs in the central part, while contrary to this, A-seam, or the lower one, varies in thickness from 3.0 meters to 10.0 meters and is separated by a thinner zone in the central part.

(d) The coal seam situation above the altitude of 1,200 meters is analyzed by a certain classification for altitude, overburden thickness, condition of coal seam, and degree of exploration, are shown graphically in frequency percentages. The percentage of the unknown and unproved areas for both A and B seams come up to about 40% respectively.

(e) The theoretical coal reserves of A and B seams are calculated in accordance with the above mentioned classifications, and summarized in the attached table.

The total amounts to <u>197,691,000 tons</u>, or 105,440,000 tons for A-seam and 92,251,000 tons for B-seam. The tentative recoverable reserves of both seams in the object area are calculated on the understanding that a room and pillar mining method with continuous miner applied in the part where the inclination is gentle enough to drive with pitch angle of less than 7^{o} in seam thickness of more than 3.0 meters, which amount to 21,891,000 tons for A-seam and 25,432,000 tons for B-seam. 46 M tns recoverable.

(f) The quality of the coal in this area is dealt with in two catagories of rank (degree of coalification) and grade (degree of concentration of clean coal). Rank variation is studied geologically, in which relationship with coking property is also studied statistically to predict future variation in products from the whole object area. Observed from these studies, B-seam could be classified to be hard coking coal, while A-seam could be classified as hard coking coal only in the southern or southeastern half of the area beyond the thinner zone.

Grade analysis is executed based on the float and sink tests of samples taken from the face of the tunnels, of which results are all summarized by computer to reveal the optimum economic washery planning. The surmised specification of clean coal from the washery dealing only with B-seam will be as follows.

Total Moisture	(%)	6
Ash	(")	8
Volatile Matter	(")	20 - 22
F.S.I.		6 - 8
Total Sulphur	(%)	0.5
Washery Yield	(")	70

(g) From the view point of mining technology, the roof and floor conditions are judged to be favorable with only some exception, and the hardness of coal is capable for mechanical mining.

2. Conclusion and Future Subject

We have made a geologically inferred evaluation of the field especially for the surveyed area, the result of which will not differ greatly from the future exploration result in general, though nearly half of the object area still remains to be proved. Based on the presently available data, a fundamental decision is now required as to whether the present data would suffice for the development or should the remaining half be explored and proved for the management of this field.

We can conclude from the present result of our investigation that the variations in thickness (lateral change) and quality (both rank and grade) are rather remarkable compared with those of paleozoic coal basins, and that the quantity -- tentatively estimated recoverable reserves of hard coking coal in proved area for example -- is not over-extravagant for an easy million-ton mining unit dealing with variably inclined seams being covered with thick overburden at lower altitude.

Supposing that the mining operation is limited to B-seam and the southern or southeastern half of A-seam, and that the products are washed properly, the washed clean coal will sure be welcomed by the Japanese steel mills, though the yield value in washery will be expected rather variable, around 70%. Even though we are relying upon these assumptions, in comparing with other competitive coalfields around the world under the conditions of present and future coking coal demand, the ultimate key for resolving these problems shall depend on the economic mining technics based on these evaluations.

Here, we have decided in accordance with the agreement concluded between Pacific Coal Limited and Mitsui Mining Co., Ltd. to carry on our exploration upon obtaining its permission from P.C.L. in the remaining area where the inclination of the coal seams is expected to be fairly gentle with simple geologic structure, and in the undulated zone in the northern part where the early development activities will take place. These explorations will be executed in 1970 and a feasibility study will be made upon the result of the exploration.