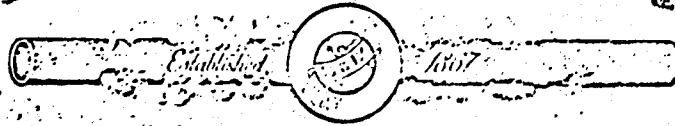


The Babcock & Wilcox Company



DIVISION
GENERAL OFFICE
BARBERTON, OHIO

BOILER DIVISION

DISTRICT OFFICE

161 EAST 42nd STREET
NEW YORK 17, N. Y.

CABLE ADDRESS
GLOVEBOXES

TELEPHONE
MURRAY HILL 7-6700

February 7, 1966

Parsons-Jurden Corp.
26 Broadway
New York, N.Y.

Attention: Mr. M.S. Umbenhauer

Re: Coal Analyses
Yukon Territory Coal
Our Reference - IS-8596

Gentlemen:

Attached hereto you will find four (4) copies of a report by our Mr. A.F. Duzy Fuel Specialist, dated, February 4, 1966. This report is based on the analytical work done by our Alliance Fuels Laboratory on the samples of coals forwarded us by Mr. M.G. Grant and identified in his letter of December 2, 1965.

You will note from this report that the coal appears to be an excellent one for providing steam, and the only requirement would be that the boiler furnace should be adequately sized to prevent slagging with the low temperature fusing characteristics of the ash. If you have any questions in connection with this report please let us know.

In so far as the use of this fuel for metallurgical purposes, would you be kind enough to advise us whether you wish to forward samples for further tests.

Very truly yours,

THE BABCOCK & WILCOX COMPANY
New York District


S.H. Reid

SJR:hh
Encs.

be about 10 per cent lower than anticipated (40 and 5.5).

Ash Fusibility

This coal has a lignite type ash, that is, the CaO plus MgO content exceeds, the Fe₂O₃ content. There is, however, a sufficient amount of acidic constituents in the ash, as indicated by the low fusion temperature ranging from 2170 to 2290F.

The temperature spread between the reducing and oxidizing fusibility points is small because of the low iron oxide content.

Ash Viscosity

The calculated viscosity of the coal ash-slag is also low. The 250 poise viscosity occurs at temperatures ranging from 2190 to 2320F.

The basic constituents are composed mainly of lime and magnesium oxide. The dolomite ratio;

$$\frac{(CaO + MgO) 100}{Fe_2O_3 + CaO + MgO + Na_2O + K_2O}$$

is also high, ranging from 70 to 80, comparable to a typical lignite type ash. This ash-slag would be expected to be a "short" slag, i.e. the fluid temperature range of the slag will be smaller compared with a non-lignite type ash having the same 250 poise viscosity temperature range.

Ash Fouling Characteristics

This coal ash may be considered as a low fouling type. The troublesome constituents that indicate potential ash fouling are the Na₂O, K₂O and chlorine content. These troublesome constituents are all quite low.

Grindability and Abrasiveness

The grindability values of 58 to 80 are somewhat higher than expected for coal of this rank. Considering the low sulfur content and the amount and type of ash, this coal should be relatively non-abrasive.

Burning Characteristics

The coal is weakly agglomerating as evidenced by the low free swelling index. It should be a relatively free burning coal and also have good ignition characteristics.

Utilization-Stoker Firing

This coal properly sized should be entirely suitable for firing in underfeed, overfeed or spreader stoker type equipment.

Care should be used in furnace design for selecting heat

CYPRESE MINE COAL
Near Carmacks, Yukon Territory, Canada

This report is divided into two main sections in order to separate steam coal and metallurgical coal usage. No information has been supplied pertaining to method of sampling the mine run coal or the channels. Therefore, the following comments are based upon the assumption the sampling methods used represent the as-mined coal.

The coal rank is high volatile B bituminous. This is based on an average 36 per cent volatile matter content (mineral-matter-free, dry basis) and 13,700 Btu/lb (mineral-matter-free, moist basis). The coal is thus similar in rank to that from some of the higher rank seams in western Kentucky, Illinois and Indiana. Analyses of all samples appear in the attached compilation.

STEAM COAL

Coal Preparation

The moderate ash content of 12 to 16 per cent, low sulfur content of the coal and the ash characteristics preclude any consideration of upgrading the coal by mechanical cleaning.

If dry mining conditions prevail, the only preparation facilities required will be crushing, dustproofing and/or freeze-proofing for transport, and conveying and storage facilities. If dustproofing or freezeproofing is required it is recommended that light oil treatment be used in accordance with accepted procedures.

Moisture Content

The equilibrium moisture content of this coal is quite low, ranging from 3.8 to 4.6 per cent; this is the inherent or bed moisture of the coal.

Air drying the coal to one to three per cent moisture content is readily attained; this is the residual moisture.

Sulfur Content

The sulfur content of the coal is very low ranging from only 0.3 to 0.4 per cent on a dry basis. The low level of this impurity is also indicated by the low iron oxide content of the ash.

Volatile Matter and Hydrogen Content

The volatile and hydrogen contents of the coal appear to be low for coal of this rank. The dry, ash-free values are about 37 and 5 per cent, respectively. One might consider these to

Cyprus Anvil Mining Corporation

From: J. Glenn Simpson Date: 26⁻⁷⁻ 76

To: R.O. ~~Fort~~

Something fishy about this Reel, apart from high vitrinite content, I thought you could only recover a 5' seam with block footage #s in core boxes legged. While they needed here, ream coal for testing the

inherent 2 seams

$$180-192' = 12'$$

and

$$195.6-211.6 = 16'$$

a few days from your estimate of 5' of coal. Any suggestions

J.S.

CONFIDENTIAL

CANADA
DEPARTMENT OF ENERGY, MINES AND RESOURCES
MINES BRANCH
OTTAWA

RESULTS ANALYSIS COAL SAMPLES 71-2

Fuels Research Centre
Divisional Report FRC 72/48-FSC

EVALUATION OF COKING COALS FROM
CARMACKS AREA, YUKON TERRITORY

by

B. N. Nandi and D. S. Montgomery

May 1972

EVALUATION OF COKING COALS FROM
CARMACKS AREA, YUKON TERRITORY

by

B. N. Nandi* and D. S. Montgomery**

INTRODUCTION

Four coal samples from the diamond drill Hole #2 in the Carmacks Area, Yukon Territory were sent by Mr. J. E. Hlavay, President, Teslin Exploration, to the Fuels Research Centre for chemical and petrographical evaluation. The property from which the samples were taken is located in Drill Hole #2 in the Carmacks (near Anvil Mines) area as shown on the map (Figure 1).

SAMPLES STUDIED

- Sample 1 - 180' - 190' - Powdered coal about minus 48 mesh partial size.
Sample 2 - 192' - Lump coal of various sizes ranging from 1/4" to 3".
Sample 3 - 195.6' - Lump coal of various sizes ranging from 1/4" to 3".
Sample 4 - 211.6' - Core sample of 2" diameter and 4" long.

The four samples weighing about 100 to 250 gms each, were received in plastic bags. Parts of the samples were crushed in accordance with the ASTM Specification for Proximate and Ultimate Analyses, Free Swelling Index, Dilatation Test and Microscopic Examination. These samples are rich in mineral carbonates and part of all 4 samples were leached with 1:1 hydrochloric acid: water for proximate and ultimate analyses and dilatation tests.

EVALUATION PROCEDURE AND RESULTS

- (a) Proximate Analysis (Moisture, Ash, Volatile Matter and Fixed Carbon)
(b) Calorific Values

Standard ASTM procedures were followed for these determinations and the results are given in Table 1.

* Research Scientist, Fuels Research Centre, Mines Branch

** Head, Fuels Research Centre, Mines Branch

(c) Free Swelling Index

The ASTM Standard Method of Test for Free Swelling Index of coal, ASTM Designation D720-67 procedures was followed and the results are presented in Table 1.

(d) Ultimate Analysis (Carbon, Hydrogen, Nitrogen and Oxygen)

This analysis was performed in Perkin Elmer Model 240 Micro-elemental Analyser and the results are given in Table 1.

(e) Ruhr Dilatometer Test

Reflectance measurements do not, except in severe cases, indicate the extent to which the coal has been oxidized. However, the determination of the dilation properties using the Ruhr Dilatometer together with the microscopic examination of the residue from the dilatometer test gives a better understanding of the nature of the coal and some indication of the state of oxidation of coal. The test measures quantitatively the contraction and dilation of coal when heated at a constant rate of temperature increase of 3°C per minute. This test was conducted according to the German Specification DIN 51739. Coals which show no dilation and very low contraction, although they may agglomerate, are not considered to have the required qualities that will yield a commercial grade of metallurgical coke. The results of this test are given in Table 1.

(f) Microscopic Examination - Maceral Analysis

The samples were polished in accordance with the procedure described in ASTM Designation D-2797, "Method of Preparing Coal Samples for Microscopic Analysis by Reflected Light".

The maceral analyses were conducted according to ASTM Designation D-2799, "Method for Microscopic Determination of Volume Percent of Physical Components of Coals". The macerals were counted at a magnification of 600. The results are given in Table 1.

(g) Reflectance Measurement of Vitrinoid

The reflectance measurements were performed on the polished samples (prepared for microscopic examination described above) according to ASTM

Designation D-2798, Tentative Method for "Determining Microscopically the Reflectance of the Organic Components in a Polished Specimen of Coal". The results are given in Table 1.

DISCUSSION

The Free Swelling Index values of these coals range from 5-1/2 to 9, which were very unusual for high-ash content coal. In order to ascertain whether these high F.S.I. values were due to the evolution of carbon dioxide, Samples 2 and 4 were leached with hydrochloric acid (1:1). The evolution of a tremendous amount of gas, mostly carbon dioxide, indicates that this coal was rich in carbonate minerals. The F.S.I. of the leached coal decreases considerably. Most of the analyses were performed on the leached coal to obtain a better evaluation of the coal substance freed from the hydrochloric acid soluble minerals.

The volatile matter of Samples 1 and 2 (supposed to represent the upper part of seam 180' to 192') was approximately 20% with high-ash content of approximately 36%; whereas the lower part of seam, Samples 3 and 4 (depth 195.6' to 211.6'), the volatile matter was higher, of the order of 27% with a low-ash content of 1.5 to 11.6%.

Petrographic analysis shows all samples consist of about 95 to 98% vitrinite which is very remarkable for coals of any rank. Many difficulties were encountered in classifying this organic matter (vitrinite). The problem was to determine whether the material was impsonite or coal. Microscopically, impsonite has the same structure as coal but it has a hydrogen content of (4.8 - 5.5%) and an oxygen content (1.9 to 5%). The hydrogen content of these coal samples varies from 4.5 to 5.5% and oxygen content 5 to 7%. From the structure of the semi-coke and the results of the ultimate analysis, it is concluded that these samples are not impsonite but coal.

Dilatometric results show that all original coals have high dilatation and contraction. The dilatation of leached Samples 2 and 4 decreases to nil and 24% from 166 to 245% respectively. This decrease in dilatation is probably caused by the removal of carbonate material from the original coal sample. Contraction and plasticity index was also slightly affected.

CONCLUSION

Coal Samples 1 and 2 (upper seam) have a higher ash content than Samples 3 and 4 (lower seam). In spite of a high-ash content the coals have good plasticity and dilatation. The High Free Swelling Index also indicates that these coals are fluid though carbonates are partly responsible for the high swelling index. The rank of the coal is in the range of medium volatile as determined by Reflectance Measurement and Proximate Analysis.

Petrographic Analysis shows these coals are mainly composed of vitrinite which acts as a reactive component in coke making and about 1 to 2% other macerals which are termed as inerts (fusinite, semi-fusinite and micrinite). We would like to point out that it is very unusual to find a coal seam such as this which consists of almost pure vitrinite. The geologists familiar with this area in the Geological Survey of Canada consider that such an occurrence is so unlikely that they question whether the sample submitted represents the entire seam.

The usual specification for coking coal is that the mineral matter be less than 10 %. It is therefore clear from the proximate analysis of the acid leached samples that extensive washing is necessary to reduce the mineral matter content to acceptable levels.

Samples 1, 2, 3 and 4 were leached with hydrochloric acid to remove the carbonates so that the volatile matter indicated could only be derived from the coal substance. It was essential to do this in order to classify the coal and to differentiate it from the vein hydrocarbon impsonite.

The dilatation of the non-acid washed Sample 2, was 166 while the acid washed material was nil. It was concluded that the dilatation of this coal was considerably influenced by the carbon dioxide released from the mineral matter. The same comment applies to the acid washed and non-acid washed Sample 4. The contraction of the coal samples submitted indicates that this coal if it can be successfully cleaned to remove the mineral matter would make a very good blending coal for combination with other low-volatile coals of low fluidity from western Canada. With these limitations we consider that this coal could find a market in the Japanese coking coal trade.

Table 1

Proximate Analysis*

	Sample 1 <u>180' -190'</u>	Sample 2 <u>192'</u>	Sample 3 <u>195.6'</u>	Sample 4 <u>211.6'</u>
Moisture	0.48	0.51	0.29	0.54
Ash	37.06	35.24	1.51	11.64
Volatile Matter	19.37	20.60	28.71	26.49
Fixed Carbon	43.09	43.65	69.78	61.67
F.S.I. non-acid leached	5-1/2	9	6-1/2	9
F.S.I. acid leached		7-1/2*		5-1/2*

*Ultimate Analysis (on ash-free basis)

Carbon %	83.8	81.0	77.0	82.42
Hydrogen %	5.3	4.7	4.5	4.9
Nitrogen %	1.1	0.99	0.78	1.0
Oxygen %	7.07	7.44	5.15	5.39
H/C	0.76	0.69	0.70	0.71

Dilatation Tests

Softening Point °C θ_S	396	396 400*	387	384 405*
Contraction % C	22	19 21	28	26 25
Max. Temp. of Contraction °C θ_C	463	450 489	447	440 470
Dilatation %	22	166 Nil	168	245 24
Max. Temp. of Dilatation	498	501 -	507	507 507
Plasticity Index $\frac{C}{\theta_C - \theta_S}$	0.32	0.35 0.24	0.46	0.46 0.40

Reflectance Measurement

Max. Reflectance in Oil R _o	0.96	1.1	1.06	0.98
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Petrographic Analysis

Vitrinite (Reactive)	> 98 %	> 98 %	> 98 %	> 98 %
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*Analysis and tests done on 1:1 hydrochloric acid leached sample.

CARMAUS NORTH - SUMMARY OF ANALYSES PRIOR TO 1976.

SEAM	TYPE OF ANALYSIS	MOISTURE %	ASH %	VOLATILES %	FIXED CARBON %	SULPHUR %	B.T.U./lb.	F.S.I.	SOURCE OF DATA.
H.W.	A.R.	13.64	2.69	31.83	51.84	—	—	—	Cairnes, 1910; p.53
Main	A.R.	16.32	9.83	31.72	42.13	—	—	—	"
F.W.	A.R.	12.87	5.90	31.72	49.51	—	—	—	"
Main	A.R.	6.1	8.9	31.2	53.8	—	11,800	—	Bostock, 1934; p.61
	Dry	—	9.5	33.2	57.3	—	12,500	—	"
Main	A.R.	5.6	11.3	33.7	49.4	—	11,840	—	"
	Dry	—	12.0	35.7	52.3	—	12,550	—	"
Main	A.R.	6.6	10.9	31.3	51.2	0.4	10,940	—	Dick, 1947; p. #28,834
"	"	4.2	18.7	29.9	47.2	0.3	10,510	—	" #28,835
"	"	4.9	20.7	29.3	45.1	0.3	10,040	—	" #28,836
"	"	3.8	11.0	32.0	53.2	0.3	11,980	—	" #28,837
"	"	4.2	13.4	30.1	52.3	0.3	11,330	—	" #28,838
"	"	4.7	10.9	31.5	52.9	0.3	11,630	—	" #28,839
"	"	3.5	9.8	31.0	55.7	0.5	12,250	—	" #28,840
"	"	6.2	16.7	29.9	47.2	0.4	10,520	—	" #28,841
Main	A.R.	3.0	9.6	35.1	52.3	—	12,200	1	Research Council of Alberta
	Dry	—	9.9	36.1	54.0	—	12,580	—	April 11, 1960
Main	A.R.	4.0	13.5	31.7	50.8	0.9	11,440	0	Fuels Division, Dept. of Mines
	Dry	—	14.1	33.0	52.9	0.9	11,920	—	Oct 17, 1966.

CARMACKS SOUTH - SUMMARY OF ANALYSES PRIOR TO 1976

SEAM	TYPE OF ANALYSIS	MOISTURE%	ASH %	VOLATILES%	FIXED CARBON%	SULPHUR%	B.T.U./Lb.	F.S.I.	SOURCE OF DATA.
Bottom	A.R.	0.75	20.43	23.61	55.21	—	—	—	Cairnes, 1910; p. 52.
Middle	A.R.	0.76	15.90	24.74	58.60	—	—	—	"
Top	A.R.	0.82	8.03	25.12	66.03	—	—	—	"
Bottom	Dry	—	16.2	27.8	56.0	—	12,220	—	Cairnes, 1910; p. 63.
	Washed, Dry	—	12.7	28.1	59.2	—	12,980	—	"
Middle	Dry	—	19.2	26.7	54.1	—	11,360	—	"
	Washed, Dry	—	14.0	25.7	60.3	—	12,730	—	"
Top	Dry	—	17.0	25.0	58.0	—	12,060	—	"
	Washed, Dry	—	13.9	26.3	59.9	—	12,800	—	"
Hole 73-2									
180.0-190.0	A.R.	0.48	37.06	19.37	43.09	—	—	5½	Phillips, 1973
192'	A.R.	0.51	35.24	20.60	43.65	—	—	9	"
195.6'	A.R.	0.29	1.51	28.71	69.78	—	—	6½	"
211.6'	A.R.	0.54	11.64	26.49	61.67	—	—	9	"

able for lode deposits. These areas include a variety of rocks besides those of the Yukon group, with which placers are generally associated in other districts of Yukon. Thus the best known placers of Carmacks district, those of Nansen and Victoria creeks, are mainly in areas of Tertiary acid intrusives.

When searching for placers it is important also to consider whether the country has been glaciated. This particularly applies in Carmacks district as parts of it have escaped glaciation. Placers formed before the glacial period would in most cases be scoured away by ice movement or buried beneath drift deposits. The features of the last glaciation are still fresh and unmodified by post-glacial erosion, showing that the time since the disappearance of the ice-sheet has been too short for placers to form. For this reason the western limit of the last ice-sheet has been indicated on the map.

It has already been mentioned that parts of the district, in the vicinities of Selkirk and Nansen creek, outside the limit of the last glaciation, were subjected to an earlier glaciation. The importance and extent of the earlier glaciations are not fully known. However, the placers of Nansen and Victoria creeks lie on top of the old boulder clay and have, therefore, been formed since the earlier glaciation. For this reason the areas that were subjected only to the earlier glaciation are not to be regarded as being unfavourable for placer prospecting ground.

COAL

Coal has been known in the district since the earliest explorations by Dawson, in 1887¹, who noted the presence of thin seams in the Laberge series at a locality that subsequently became the site of the Five-finger coal mine some 5½ miles above Five-finger rapid. Later, coal was found at what became the Tantalus and Tantalus Butte mines on Lewes river above Carmacks. The Tantalus Butte mine continues to produce a few hundred tons each year, most of which is sold in Dawson, but the other two mines are closed.

Tantalus Mine

This mine is on the south side of Lewes river, a mile above Carmacks, and was operated by the Five Fingers Coal Company. It has been abandoned for some years and its workings were not examined by the writer. The Tantalus conglomerates outcrop along the river bank both above and below the mine, and by their attitudes indicate the presence of a minor anticline west of the mine and a minor syncline to the east. The following account is taken from reports by Cairnes.²

"The coal outcrop on the river bank is well situated for economical working. . . . Three seams have been opened up, only the lower two of which have been worked to any extent. The seams vary somewhat in thickness, but average about 7 feet 6 inches, 6 feet 6 inches, and 3 feet

¹ Dawson, G. M.: "Report on an Exploration in the Yukon District, N.W.T., and Adjacent Northern Portions of British Columbia, 1887"; Geol. Surv., Canada, Ann. Rept. 1887-88, pt. B, p. 147.

² Cairnes, D. D.: Geol. Surv., Canada, Sum. Repts.: 1907, p. 23; 1908, p. 14; 1909, p. 24.

"Lewes and Nordanakid Rivers Coal District"; Mem. 5, pp. 64-64 and 69-69 (1910).
Guide Book No. 10, pp. 52-57 (1912).

of coal in the bottom, middle, and top seams respectively. The lower two seams have, in places, not more than 4 feet of rock between them, and the middle and top seams are generally about 7 feet apart. The coal is worked by the pillar-and-stall system, from two level entries, which have been driven about 2,000 feet. The beds in the mine workings dip to the east at angles varying from 24 degrees to 40 degrees.

"A 500-pound sample from each of these seams taken by the writer in 1908 was treated and analysed by the Mines Branch, the following being part of the results of this work.

	Upper seam		Middle seam		Lower seam	
	Raw	Washed	Raw	Washed	Raw	Washed
	%	%	%	%	%	%
Moisture in sample as received in laboratory.....	0.9	.....	0.7	.....	0.7	.....
Proximate analysis of coal dried at 105 degrees—						
Fixed carbon.....	88.0	89.9	84.1	80.3	86.0	89.3
Volatile matter.....	25.0	28.3	28.7	25.7	27.8	28.1
Ash.....	17.0	13.8	19.2	14.0	16.3	12.7
Ultimate analysis of dried coal—						
Carbon.....	6.98	.....	.....	.....	71.1	.....
Hydrogen.....	4.0	.....	.....	.....	4.3	.....
Sulphur.....	0.5	0.5	0.5	0.4	0.5	0.5
Nitrogen.....	0.8	0.8	0.9	0.8	0.7	0.8
Oxygen.....	7.9	.....	.....	.....	7.2	.....
Ash.....	17.0	.....	.....	.....	16.2	.....
Calorific value of dried coal in calories per gramme.....	6.700	7.110	6.310	7.070	6.790	7.210

The Tantalus mine was operated from 1905 or earlier until 1922. In earlier years from 3,000 to 8,500 tons a year were produced for a period of seven years or more. Much of the coal was used by the river steamers but was not found altogether satisfactory owing largely to the difficulty of distributing it to coaling points up and down the river, and the steamers reverted to the practice of using wood as fuel. Production dropped in 1918 below 1,000 tons and in succeeding years fell to a few hundred tons, until in 1922 the mine was closed.

Tantalus Butte Mine

The presence of coal seams in Tantalus butte, across the river from Tantalus mine and Carmacks, has been known from about the same time as the Tantalus mine started operation. The Five Fingers Coal Company closed the Tantalus mine in 1922 and opened the Tantalus Butte mine in 1923; because compared with the Tantalus mine it is cheaper to operate on a small scale. Since 1923 this mine has produced from 300 to 600 tons a year, most of which is used for domestic heating in Dawson.

Stocks (1936)

*Carmacks 1910
p. 63*

High values in Book 1913

1.80

Cairnes (1910)

Most of the river steamers burn this coal, and about 7,000 tons will be loaded this season.

There are three seams opened up, only the lower two of which are being worked at present; others may be found, as the formation is, in most places, heavily covered. The coal is worked by the stall and pillar system from two tunnels, which, when visited in October, were in 692 and 708 feet respectively on the bottom and middle seams. From the bottom seam nine rooms had been or were being worked, and were up from 50 to 115 feet, No. 1 having been run up 160 feet to the surface for air. From the middle seam there were ten rooms up from 70 to 150 feet. Although the seams are dirty, the coal could easily be sorted; but as wages are \$5.00 and board, for underground, and \$4.00 and board, for surface work, no sorting has yet been attempted.

The following section was measured near the end of the tunnels:

	{	Coal.....	2 feet,	4 inches.
		Shale.....	0 "	7 "
Bottom seam.....	{	Coal.....	2 "	0 "
		Shale.....	0 "	8 "
		Coal.....	2 "	11 "
		Shale.....	4 "	0 "
		Coal.....	2 "	3 "
		Shale.....	0 "	2 "
Middle seam.....	{	Coal.....	0 "	7 "
		Shale.....	0 "	2 "
		Coal.....	2 "	0 "
		Shale.....	0 "	2 "
		Coal.....	1 "	8 "
		Shale.....	7 "	0 "
Top seam.....	{	Coal.....	3 "	0 "
		Shale.....		

The measures are quite regular and can be traced over twenty miles down the Nordenskiöld river to the south and for over ten miles to the north, from which it may be inferred what an enormous amount of coal this district contains. When the measures have been prospected they may be found to extend much farther. Only coal near the river is at present of economic value. The dips are to the east and vary in the tunnels from 24° to 40°. Three average samples, E, F, and G, were taken respectively from the breasts of the bottom and lower seams and from the top seam where cross-cut from the middle seam, probably about 300 feet in. These samples analysed by Dr. Hoffman gave:

	E.	F.	G.
Water.....	0.75	0.76	0.82
Volatile combustible matter.....	23.61	24.74	25.12
Fixed carbon.....	55.21	58.60	66.03
Ash.....	20.43	15.90	8.03
	<u>100.00</u>	<u>100.00</u>	<u>100.00</u>
Coke per cent.....	<u>75.64</u>	<u>74.50</u>	<u>74.06</u>

These results show that the coals in the laboratory make a good coke, and it is hoped that they can be used when the copper deposits of Whitehorse, and the minerals in the other parts of the Yukon, become further developed. It is also hoped that these coals may be found much nearer Whitehorse.

*Calvin (1910)
P. 52
in Buck*

Bostock 1934? Mem. 284

Tantalus Butte

At Tantalus Butte, across the river from the Tantalus mine, the same measures again outcrop, but dip to the west, showing the presence of an intervening synclinal fold. The coal outcrops are near the top of the Butte, about four hundred feet above the river, wash and terrace material covering the formation lower down. The best seam seen contained five feet of good, firm, clean-looking coal with one foot of coal and shale on the bottom. Other seams were dirty and narrow, but good ones may be here obscured by drift, etc., as practically no work has been done except small surface cuttings. Altogether, the general conditions of the measures, including dip, strike, etc., are similar to those at the Tantalus mine, and the property will probably be worked in the near future. The surface samples obtained did not give a firm coke, but possibly fresh coal would give a different result. The following is the result of an analysis, by Dr. Hoffmann, of an average outcrop sample from the best seam.

Uncertain whether H/W main or F/W seam !!

Water.....	9.48%
Volatile combustible matter.....	32.28%
Fixed carbon.....	53.51%
Ash.....	4.73%

Five Fingers Mine

This is situated on the east side of the river about ten miles north of the Tantalus mine. A considerable amount of coal has been shipped from here, but the old workings are closed now on account of being dangerously situated on the steep clay and sand bank of the river, subject to mud slides. The old slope was down about 350 feet with rooms run off it, the seam in the lower rooms being three and a half to four feet wide. The new slope now being sunk is to the north and in safe ground, and at the time visited was down about 525 feet, dipping to the east at 16°. This seam, which is not the same as that mined in the old workings, was at this depth about two feet wide, and was apparently becoming wider. It had previously narrowed to about six inches. An average sample of the two feet, analysed by Dr. Hoffmann, gave:

*Carnes, D.D. (1907)
Pub No. 982
in Bostock, H.S. (1934)
Mem. 284*

Water.....	4.26%
Volatile combustible matter.....	40.26%
Ash.....	10.81%
Fixed carbon.....	44.67%
Coke per cent.....	55.52%

The coke is a firm coherent coke.

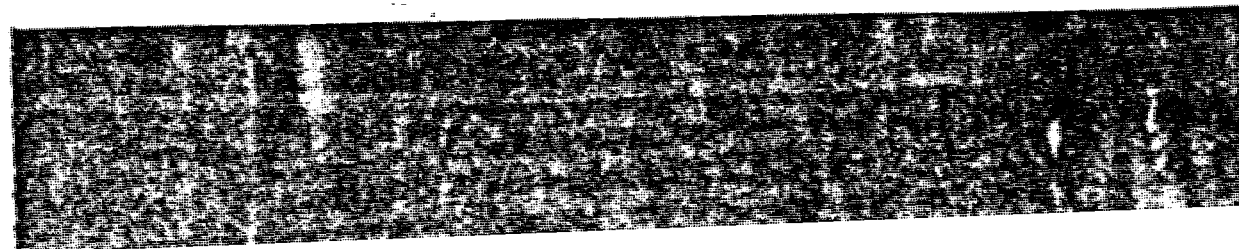
These measures are not the same as those at the Tantalus mine which appear in the valley about three and a half miles to the east of the Five Fingers mine, and also up a small creek about three or four miles to the east from the Five Fingers rapid.

Geology

General

In studying this portion of the Yukon, as in portions of British Columbia to the south, a striking similarity in the geology is noticed in a north-west and south-east direction, all the main horizons extending parallel to the Pacific coast line.

The principal geological formations have been placed in the following divisions, beginning with the oldest:



SUMMARY OF ANALYSES

TANTALUS MINE

SEAM	REP. WIDTH	WATER%	VOLATILE COMBUST.	FIXED CARBON	ASH	COLLECTOR & ANALYST	AGE OF EXPOSURE	FUEL RATIO FC/VM	B. T. U. VALVE	REFERENCE
Bottom	7'6"	.75	23.61	55.21	20.45	Cairnes	fresh	2.2	H.D.	D.D. Cairnes Memor #5 1910 Dept. of Mines
Middle	6'6"	.76	24.74	58.60	15.90	C. C. S.	"	2.3	"	
Top	3'0"	.82	25.12	56.03 (Channel samples)	8.03	"	"	2.6	"	
Top	{	Dry basis	25.0	58.0	17.0	Cairnes	regular	2.3	12,060	D.D. Cairnes
		"	26.3	59.9	13.8	Dept. of Mines	washed	2.3	12,800	
Middle	{	"	26.7	54.1	19.2	"	regular	2.0	11,360	Geol. Surv. Canada Sum. Repts. 1907-1909
		"	25.7	60.3	14.0	"	washed	2.3	12,730	
Bottom	{	"	27.8	56.0	16.2	"	regular	2.0	12,230	
		"	28.1	59.2 (500 lb. samples)	12.7	"	washed	2.1	12,980	
All these analyses are of the seams including the "bone" layers in them - on hand picking this material out, the ash content would seem to drop.										
would seem to average			26 -	60.	14	(Sulfur 4%)	Picked	2.5	12,850	

FIVE FINGER MINE

Upper	22" of 4' seam	5.95	40.46	45.16	8.43		Fresh	1.11		Dr. D. D. Cairnes Memor #5 Dept. of Mines
Lower	4' 6"	5.29	36.14	40.12	18.45	Dept. of Mines	"	1.11		

Burd. (1945)

SUMMARY OF ANALYSES

T A N T A L U S B U T T E

BEAM	REP. WIDTH	WATER	VOLATILE COMBUST.	FIXED CARBON	ASH	COLLECTOR & ANALYST	AGE OF EXPOSURE	FUEL RATIO FC/VM	BTU VALUE	REFERENCE
Top	8'10"	13.64	31.84	51.84	2.69	Cairnes & Dept. of Mines	Outcrop	1.63	ND	D.D. Cairnes
Middle	9'10"	16.32	31.72	42.13	9.83	"	"	1.53	ND	Memoir #5 1910
Lower	6'off"	12.87	31.72	49.51	5.90	"	"	1.56	ND	Dept. of Mines
Outcrop Material was classed as a "lignite", material in mine subsequently opened became a coal.										
Lower	9'9"	6.1	31.2	53.8	8.9	Bostock	Fresh	1.70	11,800	H.S. Bostock Memoir 189 1933
Middle	9'10" seam of Cairnes (1910)									
Lower	9'4"	5.4	30.7	53.4	10.5	A.R. Johnstone Dept. of Mines	1 yr.	1.75	11,930	"
13717 #	8'6"	4.5	30.9	53.1	11.5	"	45 days	1.72	11,990	"
13718 #	8'0"	3.7	32.9	54.3	9.1	"	40 days	1.65	12,490	"
13719 #	9'0"	5.6	33.7	49.4	11.3	"	Fresh	1.45	11,840	"
13720 #	Softening point of ash 2,330 F. Sulfur content -0.4%									
Other than a 3% loss in volatiles and resulting change in fuel ratio, no important changes show that might affect stock - piling of the coal.										
5 tons-hand screened Slack-coal; 13721 #	4.2	32.8	53.0	10.0	A.R. Johnstone Dept. of Mines	Slack	1.60	12,250	"	
Last 5 tons mined in 1934; 13722 #	4.4	32.9	51.2	11.5		Fresh	1.55	12,000	"	

Buck (1943)

COAL ANALYSIS REPORT
RESEARCH COUNCIL OF ALBERTA
UNIVERSITY OF ALBERTA

Lab. Sample No. 402-

MINE: Tantalus Butte

LOCATION:

OPERATOR:

ADDRESS: Carmacks, Yukon

DESCRIPTION OF SAMPLE: 5-6 lb. sample in cotton sack,
Taken from lower seam of mine.

SAMPLER: Donald C. Birch

DATE OF SAMPLING: January 15 & 16, 1943

SAMPLER'S NO.:

DATE RECEIVED: February 12th, 1943

MOISTURE RETAINED AT 99.9% HUMIDITY (capacity moisture) 5.0

MOISTURE RETAINED AT 60.0% HUMIDITY (air-dried moisture) 3.8

PROXIMATE ANALYSIS:

As Received Capacity Dried

Moisture	%	3.4	5.0	
Ash		10.0	9.9	10.4
Volatile Matter		34.2	33.6	35.4
Fixed Carbon		52.4	51.5	54.2

ULTIMATE ANALYSIS:

Carbon	%	70.15	68.95	72.55
Hydrogen		4.75	4.85	4.55
Ash		10.0	9.9	10.4
Sulphur		0.130	0.30	0.30
Nitrogen		0.7	0.7	0.8
Oxygen		14.1	15.3	11.4

Calorific Value, gross	B.T.U. per lb.	12,050	11,850	12,470
Calorific Value, net	B.T.U. per lb.			

Fuel Ratio (F.C./V.M.)	1.55
Carbon/Hydrogen Ratio	15.9

COKING PROPERTIES: Non-coking.

REMARKS: Initial Deformation temp. 2090°F; Softening temp. 2160°F; Fluid Temp. 2260°F. The softening temperature is the temperature usually taken as the fusion temperature of the ash.

This sample, which was received in a cotton bag, may have dried out somewhat in shipment, as humidity tests showed that this sample could contain 5.0% moisture (capacity moisture) without being damp. The analysis with capacity moisture is shown in the middle column.

Date February 23rd, 1943

Signed: D. W. Clarke

Approved: E. Stanfield (?)

COAL ANALYSIS REPORT

Lab. Sample No. 401-43

Research Council of Alberta

University of Alberta

MINE: Old Tantalus Mine

LOCATION:

OPERATOR:

ADDRESS: Cormacks, Yukon

DESCRIPTION OF SAMPLE: 5-6 lb. sample in cotton sack.
Lower seam at 9'.

SAMPLER: Donald G. Birch
SAMPLER'S NO.:

DATE OF SAMPLING: Jan. 15 & 16, 1943
DATE RECEIVED: Feb. 12th, 1943

MOISTURE RETAINED AT 99.9% HUMIDITY (Capacity moisture) 2.1
MOISTURE RETAINED AT 60.0% HUMIDITY (air-dried moisture) 1.3

PROXIMATE ANALYSIS:

	As Received	Capacity	Dried
Moisture	0.9	2.1	
Ash	28.4	28.0	28.6
Volatile Matter	21.9	21.6	22.1
Fixed Carbon	48.8	48.3	49.3

ULTIMATE ANALYSIS:

Carbon	59.95	59.20	60.43
Hydrogen	3.65	3.70	3.53
Ash	28.4	28.0	28.6
Sulphur	0.30	0.30	0.30
Nitrogen	0.8	0.8	0.8
Oxygen	8.9	8.0	6.3

Calorific Value, gross B.T.U. per lb. 10,230 10.110 10.320

Calorific Value, net B.T.U. per lb.

Fuel Ratio (F.C./V.M.) 2.2

Carbon/Hydrogen Ratio 17.0

COKING PROPERTIES: Non-coking.

REMARKS: Initial Deformation temp. 2250°F; Softening temp. 2340°F; Fluid temp. 2450°F. The softening temperature is the temperature usually taken as the fusion temperature of the ash.

This sample, which was received in a cotton bag, may have dried out somewhat in shipment as humidity tests showed that this sample could contain 2.1% moisture (capacity moisture) without being damp. The analysis with capacity moisture is shown in the middle column.

Date - February 23rd, 1943.

Signed D. W. Clarke

Approved E. Stanfield. (?)

W. J. Dick
Butler
1947

Channel samples across the seam were taken and sent to the Department of Mines Division of Fuels for analyses. It is to be noted that the channel samples were taken from striped sections of the seam but as the coal in the main level had stood for many years it had suffered some weathering from the action of the mine air. The chute samples also had been subjected to weathering and these samples were taken for the purpose only of indicating the quality of coal formerly shipped under the conditions of bad mining practice as explained elsewhere in this report.

The following are the results of analyses as reported by R. E. Gillmore, Chief Division of Fuels.

Main Seam

Lab. No.	28,834	(Marked 1)	- Channel sample	at Station	8	
"	"	28,835	(" 2)	- Chute	"	8
"	"	28,836	(" 3)	- Chute	"	7 x 12 ft.
"	"	28,837	(" 4)	- Channel	"	8 x 30 ft.
"	"	28,838	(" 5)	- Channel	"	5 x 20 ft.
"	"	28,839	(" 6)	- Channel	"	3 x 28 ft.
"	"	28,840	(" 7)	- Channel	"	1
"	"	28,841	(" 8)	- Chute	"	2

Laboratory No.	Analyses			
	1 28,834	2 28,835	3 28,836	4 28,837
Moisture.....%	6.6	4.2	4.9	3.8
Ash.....%	10.9	18.7	20.7	11.0
Volatile matter....%	31.3	29.9	29.3	32.0
Fixed Carbon.....%	51.2	47.2	45.1	53.2
Sulphur.....%	0.4	0.3	0.3	0.3
B.T.U./lb.....	10,940	10,510	10,040	11,980
Caking properties..	Non-Agglom.	Non-Agglom.	Non-Agglom.	Agglomerating
Ash softening Temp. °F	2290	2350	2215	2250

Laboratory No.	5	6	7	8
	28,838	28,839	28,840	28,841
Moisture.....%	4.2	4.7	3.5	6.2
Ash.....%	13.4	10.9	9.8	16.7
Volatile matter.....%	30.1	31.5	31.0	29.9
Fixed carbon.....%	52.3	52.9	55.7	47.2
Sulphur.....	0.3	0.3	0.5	0.4
B.T.U./lb, gross....	11,330	11,630	12,250	10,520
Caking properties...	Non-Agglom.	Non-Agglom.	Agglome-rate	Non Agglom.
Ash softening Temp..°F	2360	2270	2250	2260

Remarks: Although the samples were composed of small coal, the pieces broke so readily that it is evident that the deposit is composed of friable coal.

It appears as though the coal in the Tantalus Butte deposit may have been considerably affected by weathering of some kind. Apart from the first and last samples, which were most likely more weathered than the other coals, the calorific values place the coal in the High Volatile Bituminous group. This is on the assumption that the moistures as reported correspond with the natural-bed (or "capacity") moisture.

Results of Analyses on Samples of
Tantalus Butte Coal, Carmacks, Yukon Territory

The results of analyses on eight samples of coal from the Tantalus Butte deposit at Carmacks, Yukon Territory, collected and submitted by Dr. B. R. MacKay and W. J. Dick are shown individually in attached report No. 7199. These comprise five channel samples, viz., their Nos. 1, 4, 5, 6 and 7 and three chute samples Nos. 2, 3 and 8. The results may be summarized as follows:

	<u>Channel Samples</u>	<u>Chute Samples</u>
Moisture content.....%	3.8 to 6.6	4.2 to 6.2
Ash (as received).....%	9.8 to 13.4	16.7 to 20.7
B.T.U./lb. (as received)	10,840 to 12,250	10,040 to 10,520
Average B.T.U./lb	11,630	10,530
Caking properties	Non-caking	Non-caking

These are high volatile bituminous coals, and according to their calorific values, belong to the B group of that class. Indications are that the coals represented by these samples are somewhat weathered, and whether freshly mined coal from unexposed parts of the seams will reveal coal with more pronounced caking properties--characteristic of high volatile B (A) groups--is debatable and subject to confirmation by mining operations.

These coals in respect to heating value are similar to coals from the McGrath, Saunders, and Coalspur areas in Alberta.

They are roughly 1,000 B.T. higher in calorific value than the Brucheller coals, but are quite friable.

The Tantalus Butte Coals evidently are suitable for steam raising; and also for domestic purposes depending on the amount of the lump size. Mining operations only will demonstrate the proportion of lump sizes--say, down to Nut Pea--for domestic use; and for steam raising purposes, they may be utilized in hand or stoker fired boilers, or as pulverized fuel.

From this report it is evident that the coal ranks a good grade of high volatile bituminous coal and that the ash is not excessive compared with other similar coals in Canada.

Faults

No major faults were found although a fault was observed cutting across the lower and upper seams near the entrance to the mine. The fault caused little or no vertical displacement. It is to be noted that the Tantalus workings were cut off by a fault and since only some 550 feet of the Tantalus Butte seam has been developed and not disturbed by faults it cannot be said until further development is done whether extensive faulting occurs at this mine or not.

Surface Plant

The company had spent considerable money in a surface plant for screening and carrying the coal from the mine mouth to the loading point on the river. The following is an outline of these operations. Coal was trammed out of the mine in small open-end mine cars. As the grade on the surface near the entrance to the mine was less than a coal running pitch (in chutes) the cars were lowered for several hundred feet by a small steam hoist and dumped on an end tip-over dump into a metal lined chute. The grade of the chute being about 30°. The coal ran by gravity several hundred feet and discharged into a square steel lined bin. The bottom of the bin was fitted with a power actuated

20 January 1949

MEMORANDUM RE THE PHYSICAL AND CHEMICAL PROPERTIES
OF COAL, FROM THE TANTALUS BUTTE MINE, YUKON

The purpose of this memorandum is to review two F.R.L. reports, by E. Swartzman, on the physical and chemical properties of two lots of samples of Tantalus Butte coal, mined by the Yukon Coal Co. Ltd. Carmacks, Y. T., viz:

- Report No. 108 - On (1760 lb.) bulk, and (870 lb.) channel samples, collected by A. Ignatieff, July, 1948.
- Report No. 112 - On (3100 lb.) mine run, and (3600 lb.) screened lump, from 8-ton lot of coal, prepared by Mr. G. Miller, for combustion tests in September at White Horse, and received from there in Ottawa, November 17, 1948.

PROXIMATE ANALYSES

	P. & C. Survey		Combustion	
	July Samples		September Samples	
	Bulk ^x	Channel ^{xx}	M.R.	Lump
Moisture.....%	4.9	(4.5)	4.5	4.5
Ash	12.5	11.7	11.6	10.8
Volatile Matter...%	33.6	33.3	31.9	32.7
Fixed Carbon.....%	49.0	50.5	52.0	52.0
B.T.U./lb.	11675	11995	11525	11765

Caking properties ^{xxx}.....Poor.....

^x Analysis of bulk sample for coal from No. 5 raise only.

^{xx} Analysis of channel samples averaged & adjusted to 4.5% moisture basis.

^{xxx}As judged by residue from volatile matter determination.

Classification: According to the A.S.T.M. classification, adopted internationally by Canada and U. S. A. this coal is "High volatile B bituminous" (near the border line between the B and C groups.). The A.S.T.M. scheme is not entirely satisfactory for classifying this coal, which according to the special S.V.I. classification employed at the Fuel Research Laboratories, has properties resembling coals in the subbituminous group.

General Friability and Handling Properties: The results of screening and friability tests indicate that the Tantalus Butte coal is a friable coal producing approximately 50% ($\frac{1}{2}$ inch) slack from Run of Mine by ordinary handling during mining and transportation operations. Further degradation of the lump sizes takes place by weathering and during combustion.

Caking and General Burning Properties: Although the residue in the volatile matter determination indicates some "coke" structure, this tendency to coke or cake disappears during combustion. Therefore, the coal may be considered non-caking, and hence free burning, yet somewhat slow to ignite. Some swelling was noticed in the mine run and "fines", but the screened lumps and "smalls" showed no swelling. In this respect, the coal is definitely not suitable for use in the manufacture of coke. In respect to clinkering, the 2250°F. softening temperature of ash, and it's high lime content, explains the formation of a glassy, more or less porous and fragile, slag during combustion. For other than the lump sizes, the burning of this coal in thin layers is recommended.

Washing and Briquetting Properties: In general, the coal cannot be considered readily amenable to washing by either wet or dry methods, due to high inherent ash. Wet washing, however, may be utilized to produce fairly good yields of 10 to 13% ash product from mine run coal higher in ash, but

this quality of coal may be obtained by selecting those sections of the seam with ash contents within this range. Although there is a tendency for the ash to concentrate in the fines, it is probable that they will be amenable to briquetting in the raw state.

Summary Remarks: - The Tantalus Butte coal is a somewhat friable, non-caking high volatile bituminous coal, averaging 4.5% moisture, 11.5% ash and 11,730 BTU/lb. Though inferior in some respects, its characteristics are similar to those of coal from the Nanaimo area, B. C. The lump sizes, comprising only about half of the run of mine product are suitable as domestic fuel, and the slack sized for best results for steam raising purposes require to be burned in thin layers.

Special combustion tests on run of mine coal are being made in a spreader stoker boiler installation and briquetting tests on the fines are planned for the immediate future.

R. E. Gilmore,
Chief, Division of Fuels.

Fuel Research Laboratories,
Ottawa, January 20, 1949.

Department of Mines and Resources
Mines, Forests and Scientific Services Branch
Bureau of Mines

REPORT
ON THE BURNING PROPERTIES OF COAL
FROM THE TANTALUS BUTTE MINE, OPERATED BY
THE YUKON COAL CO., LTD., CARMACKS, Y.T.

by
C.E. Baltzer

Approved R.E. Gilmore,
Chief, Division of Fuels,
Bureau of Mines,
Ottawa, February 15, 1949.

INTRODUCTION

This report deals with the burning characteristics of coal from the Tantalus Butte mine, operated by the Yukon Coal Co. Ltd., at Carmacks in the Yukon Territory; and should be considered as a sequel to F.R.L. Report No.112*1 which fully covers the physical and chemical properties of the bulk samples provided for experimental purposes.

Some 6700 pounds of coal, consisting of three marked samples, were furnished for test at the Fuel Research Laboratories in Ottawa. These samples were as follows:

<u>Sample No.</u>	<u>No. of bags shipped</u>	<u>Approx. Weight lb.</u>	<u>Mine designation</u>
A562	21	2350	Mine run
A562(a)	3	750	Plus $\frac{1}{2}$ inch
A563	30	3600	Plus $1\frac{1}{2}$ inch

Four tons of each of these grades were originally prepared at the mine on or about September 15, 1948, under the supervision of Mr. G. Miller, Mine Manager, and shipped to Whitehorse in the Yukon Territory for hand fired steaming trials*2 made September 29, 1948, on the steamer "Whitehorse" operated by the British Yukon Navigation Company. The samples above mentioned were portions of the residue of each grade remaining from these steaming trials, and were shipped from Whitehorse to Ottawa on October 9, 1948. The shipment, consisting of 59 bags of coal contained in two large wooden crates for protection, arrived in Ottawa on November 17, 1948, in a very wet state which necessitated air-drying of the coal before processing in the laboratory.

On first examination, the samples appeared to be representative of a poor quality of bituminous coal, with an abnormal proportion of fines indicative of more than ordinary friability. The friable nature of the coal, together with the small amount insufficient for involved combustion tests, influenced decision in respect to laboratory procedure and test:-e.g., (1) special effort was made to avoid further breakage prior to firing; (2) with one exception, no upgrading of the coal in respect to size was attempted so that the tests would be made on product of as near mine grade as possible; (3) tests were limited to general observation of fire performance for which reason no elaborate instrumentation of the test equipment was attempted; (4) tests were made in several diverse types of equipment, rather than in any one, in order to obtain a better indication of the coal's suitability for general utility purposes. Because of these limitations, the opinions expressed in this report should be treated as indications of performance rather than precise criterion which can

*1. F.R.L. Report No.112 - "Study of the Physical and Chemical Properties of Two Samples of Coal from the Top Level Workings of Tantalus Butte Mine, Yukon Territory", by E. Swartzman, December, 1948.

*2. Special "Report on Combustion Test on B.Y.N. Steamer, Whitehorse, September 29, 1948", by A. Ignatieff, October 5, 1948.

only develop over a more extensive period of use.

Burning tests were made with the various samples in the following types of equipment:

1.- Space heating stoves:

- (a) Test of a portion of sample A563 (plus $1\frac{1}{2}$ inch size) in special heater designed for smokeless use of bituminous coal.
- (b) Test of a portion of sample A563 (plus $1\frac{1}{2}$ inch size) in a conventional heater having narrow, deep, fuel space, normal to station agent, Quebec and circulator types of stoves commonly used in Canada.
- (c) Test of sample A562(a) (plus $\frac{1}{2}$ inch size) upgraded to remove all fines under $\frac{1}{2}$ inch in size, in same conventional heater used for (b).

2.- Test of a portion of sample A563 (plus $1\frac{1}{2}$ inch size) machine crushed and screened minus $1\frac{1}{4}$ inch, in conventional, domestic, underfeed stoker designed for use with bituminous coal.

3.- Test of sample A562 and the major portion of sample A563 (combined mine run and plus $1\frac{1}{2}$ inch sizes respectively) with large lumps hand broken to pass feeder (approximately $1\frac{1}{2}$ inch and under), in commercial, spreader stokered, steam boiler.

The general conclusion reached was that the coal, of high volatile bituminous rank, averaging $4\frac{1}{2}\%$ moisture, 11% ash, and 11500 B.T.U./lb; was quite friable and of a non-caking, non-swelling, reactive and long flaming nature in the fire, with ash characteristics productive of a glassy, more or less porous, and friable clinker during combustion. The properties of this coal most nearly conform to those of coal from the Nicola Area, B.C.; and being of a somewhat hybrid nature had actual handling and burning properties which would indicate its most successful use in the types of equipment applied to Saskatchewan coal in the Winnipeg area. The lump coal $\frac{1}{2}$ inch and larger, i.e. with fines removed, should be quite amenable for domestic use provided equipment and firing methods applicable to a high volatile coal are used. Whereas the slack sizes $1\frac{1}{2}$ inch and under, may best be utilized for steam raising purposes, mechanically fired in thin layers. This implies overfeed rather than underfeed firing methods. The mine run grade of coal, containing a high percentage of fines $\frac{1}{2}$ inch and under may be best used in hand fired steam plants using forced draft and suitable type of dumping grate provided the necessary precautions are taken with the furnace design.

Further information in respect to both the coal and the burning tests made thereon is given in the body of this report, with a following section ~~amplifying~~ the opinions above expressed.

amplifying

SUMMARIZED COAL DATA*3

Origin:- Tantalus Butte mine of the Yukon Coal Co., Ltd., Carmacks, Yukon Territory.

Samples:- Represented three mine sizes (grades). 4 tons of each prepared at mine about September 15, 1948. Shipped to Whitehorse for steaming trials, made September 29, 1948, on S.S. Whitehorse. Portion of residue of each size remaining after test shipped from Whitehorse October 9, 1948. Received in Ottawa, November 17, 1948.

Sizes :- (1) No.A562 in 21 bags (2350 lb) mine run }
 (2) No.A562(a) in 8 bags (750 lb) Plus 1/2 inch } Crate I
 (3) No.A563 in 30 bags (3600 lb) Plus 1 1/2 inch } Crate II

State: - General appearance (in comparison with good grades of Eastern bituminous coal) slabby structure, wet, dull and dirty with considerable percentage of fines in all grades. Samples air-dried to normal moisture content before processing in laboratory.

Sample No.	A562	A563	A562(a)
Trade size.....	Mine run	+1 1/2" lump	+1/2" lump
Rank (A.S.T.M.).....	High volatile Bituminous B Bordering or C		
Screen analysis:			
Plus 8 inch.....%	1.4	7.6	
7 ".....%	1.4	1.4	3.0
6 ".....%	4.1	4.1	4.1
5 ".....%	1.8	3.2	5.4
4 ".....%	2.5	4.0	5.3
2 ".....%	12.7	18.6	22.1
1 1/2 ".....%	4.6	7.6	8.3
1 ".....%	8.4	10.8	11.3
3/4 ".....%	5.6	5.7	6.8
1/2 ".....%	9.0	7.1	10.8
1/4 ".....%	14.3	9.5	8.8
1/8 ".....%	11.7	4.1	14.1
1/16 ".....%	6.5	4.9	-
1/32 ".....%	6.5	4.3	-
Minus 1/32 ".....%	9.5	7.1	-
Average particle size.inches	1.472	2.356	2.114
Bulk density:			
Pounds per cu.ft.....	55.1	54.7	
Volume per ton.....cu.ft.	36.3	36.5	
Friability.....	48.4	48.4	
Apparent Specific Gravity....	1.303	1.303	

*3. For full details re physical and chemical properties of samples A562 and A563 see F.R.L. Report No.112.

(Cont'd) Sample No.	A562	A563	A562(a)	
Proximate analysis:				
Moisture.....%	4.5	4.4	Other than the screen analysis given here for record purpose, no other physical or chemical determinations were made on this sample which was later upgraded in size for special stove test (see page 6)	
Ash.....%	11.6	10.8		
Volatile matter.....%	31.9	32.8		
Fixed carbon.....%	52.0	52.0		
Sulphur.....%	0.44	0.43		
Calorific value, received basis.....B.T.U./lb	11525	11465		
Fuel ratio.....	1.63	1.59		
Caking properties.....	poor	poor		
Ash fusibility:....				
Initial.....°F.	2150	2210		
Softening.....°F.	2250	2300		
Fluid.....°F.	2290	2340		
Melting range.....°F.	140	130		
Ash analysis* ⁴				
SiO ₂%		48.4		
Fe ₂ O ₃%		4.2		
Al ₂ O ₃%		20.0		
CaO.....%		16.7		
MgO.....%		5.4		
MnO.....%		0.1		
Na ₂ O.....%		0.2		
K ₂ O.....%		0.9		
P ₂ O ₅%		0.1		
TiO ₂%		1.0		
SO ₃%		3.3		
Clinker specific gravity* ⁴		1.95		

*⁴. The figures reported for ash analysis and specific gravity of clinker are for a former bulk sample of unmodified mine run size from the same mine. See F.R.L. Report No. 108.

From the foregoing tabulation it will be seen that for all practical purposes, the physical and chemical properties of the mine run and plus 1½ inch lump grades of this coal are the same, with little to choose between them, except that the lump size, as would be expected, is the coarser.

As evidenced by the screen analysis, both grades have fair size distribution throughout, with slight preference in regard to uniformity again in favour of the lump size. Both grades carry an undue proportion of fines, and neither could qualify for the size designated, as judged by the Canadian Government Purchasing Standards Committee Specification for Coal No. 18-GP-1, which limits the percentage through the 1/8 inch screen to not over 15% for the mine run size, and to the same percentage through the 1½ inch screen for the plus 1½ inch lump size. Therefore, it is apparent that this coal is friable and subject to more than ordinary disintegration on handling.

Aside from friability, the outstanding characteristics from a combustion standpoint are that the coal; averaging 4½% moisture, 11% ash, and 11500 B.T.U./lb; is of a non-caking, non-swelling, reactive and long flaming nature in the fire, with ash characteristics productive of a glassy, more or less porous, and friable clinker when forced during combustion.

Although ranked as a high volatile bituminous coal its handling and burning qualities more nearly approach those of the sub-bituminous group. This would imply that the coal is of hybrid nature, and as such, may require some care and discretion in selection of burning equipment if optimum results are to apply.

SUMMARY OF BURNING TESTS

Due to the limited quantity of coal available, no elaborate combustion tests could be made. Therefore, the results were gauged chiefly by general observation of fire performance rather than by instrumentation of the test equipment. However, tests were made in several types of burning equipment, which gave an indication of the coal's overall suitability for general utility purposes, but did not set definite limits for any particular service, because to do so would require more lengthy and continuous operation, under both severe and varying load conditions, than was here possible. It was also thought that the tests, insofar as possible, should be confined to the grades of coal most easily provided by the mine: i.e., without upgrading to sizes outside the mines ability to supply. For these reasons the information following is largely summarized from the notes taken during the burning, and is presented in discussion form under headings covering the class of equipment in which the coal was used.

1. Space Heating Stove Tests:

- (a) In special BCR-2C Smokeless Heater:*5 a five day observation burning test was made in this stove, designed for burning bituminous coal smokelessly, using a portion of sample A563 (plus 1½ inch lump size) in the state received with the exception that the large lumps were reduced by hand cracking so that the top size fired approximated 3 inches. The fuel was fired to the magazine in full charges as recommended by the manufacturer, thus maintaining a deep fuel bed at all times.

Serious difficulty was encountered throughout this test in maintaining both uniformity of heat output and the rated output of the stove, and the fire required constant attention to obtain any degree of satisfaction at all. The fire was sluggish and slow to respond to draft changes and the cup grate under the arch required

*5. For details regarding the BCR-2C heater see F.R.L. Report No.98, September 1, 1948.

dumping so often that an excessive loss to the ashpit resulted. However, even under unfavourable burning conditions no smoke of account or puff backs resulted and no clinkers were noticed in the refuse removed from the ashpit.

Later experience indicated that the whole trouble was due to excessive fines in the coal. Had coal within the limits of 1/2 x 3 inches been used it is believed that satisfactory performance in every regard would have resulted.

- (b) In Army Cannon Heater*6- (Conventional Station Agent Stove):- A four day observation burning test was made in this stove using a portion of the same coal sample used in the BCR-2C heater with much the same result.

The fuel was fired both in full and partial charges, with both conventional deep fuel bed conditions, and the more shallow bed obtained by alternate front to rear firing leaving a portion of red coal exposed at all times possible. Neither method of firing was very successful, giving the impression that the coal was of a non-reactive, slow burning nature, very slow to ignite, and requiring more than the ordinary amount of draft. Here again, the trouble was due to the blanketing effect of the excess fines, as later experience with a better sized coal gave evidence of the reverse.

- (c) In Army Cannon Heater With Upgraded (sized) Coal: a three day observation burning test was made in this stove, using an upgraded size prepared from sample A562(a) - so called plus 1/2 inch lump. The total amount of this sample remaining after the laboratory screen test was rescreened over a 1/2 inch round hole screen. The burning test was made on the plus 1/2 inch product so obtained after the large lumps had been reduced by hand cracking so that the top size fired approximated 3 inches. The minus 1/2 inch product which amounted to 51% of the total (an exceedingly high figure) was set aside for special briquetting tests yet to be made.

The fuel was fired in three small progressive charges during the first half to three quarter hour of each firing period with alternate front to rear firing leaving a portion of red coal exposed at all times as is usual for high volatile coals. Two, six to seven hour periods at the full rated output of the stove were made each day with an 11 to 12 hour banking period during the night. Thus the stove was charged three times during a 24 hour period using approximately 80 pounds of coal per day. Performance was much more satisfactory indicating that excessive fines were mostly, if not totally, responsible for the unsatisfactory results reported in the two foregoing tests.

*6. For details regarding the army cannon heater see special "Report on the Suitability of Various Fuels For Use in Station Agent Type Stoves Employed by the Department of National Defence", March 19/41.

During this test the coal did not cake, swell or bridge in the fire, appeared to be of a reactive and long flaming nature, and quickly responded to draft changes. No difficulty was experienced in maintaining the rated output of the stove; the uniformity of heat output and overall combustion conditions were reasonably good; and the loss to the ashpit was not unduly high with no evidence of clinker formation on the grate. Under the circumstances it may be concluded that this coal should give reasonable satisfaction if used for domestic heating purposes provided it does not contain an excessive amount of fines.

2. Domestic, Underfeed Stokered, Hot-Water Boiler Test:

A three day observation burning test was made in the experimental domestic hot-water boiler test unit*7 maintained at the Fuel Research Laboratories in Ottawa, using a portion of sample A563 (plus 1½ inch lump) machine crushed to pass a 1½ inch round hole screen. The screen analysis of the product as fired was as follows:

Plus 1½ inch.....%	nil	} This conforms to a 1½" slack size, in accord with C.G.P.S. Committee specification No.18-GP-1, and is a normal size for use in stokers of this type.
1 "	14.8	
½ "	37.4	
1/8 "	29.9	
1/32 "	12.3	
Minus 1/32 "	5.6	
Average particle size		
.....inches	0.552	

domestic

The round, four section, cast iron, water boiler, with rated output of 132000 B.T.U. per hour, was fired by means of a conventional domestic type underfeed stoker fitted with bituminous coal burner head and full complement of electrical controls.

Due to the free burning (non-caking) nature of the coal, which lay loosely over and within the retort, great difficulty was encountered in maintaining proper air adjustment for changing fire conditions. For the average condition, with varying fuel bed depths of from 4 to 8 inches and normal air supply, the coal assumed a convex contour, mushroomed out over the retort, and burned at the edges only, leaving a large area of green (non-burning black) coal in the center. This gave the impression of a dead, unreactive fire, and relatively short, dull, dirty, yellow flame characteristic of too little air. However, blow holes were quick to develop, at some part of the retort edge, allowing an excess of air with long, bright, hot, sparkling flames blasting the underside of the water sections giving the opposite impression.

*7. For details regarding this experimental test unit, see Bureau of Mines Bulletins 671-2, 705, 761 or 802.

On the whole, combustion conditions were not considered good, the fly carry-over was excessive, and the fire cleaning chore created more dirt than desirable. Under the circumstances, the coal cannot be recommended as being good for use in the small conventional type of underfeed stoker. However, provided ideal conditions are not demanded, the coal can be so used, and the results above reported could no doubt be bettered by using an alternate style of burner head such as is more commonly used for Saskatchewan coal.

3. Commercial, Spreader Stokered, Steam Boiler Test.

The balance of samples A562 and A563 (approximately 1½ tons) was tested in a small commercial steam plant in comparison with the coal normally used. The plant was selected as having firing and accessory equipment considered suited to the Tantalus Butte Coal, and was at a point where competent technical service personnel was available to aid with the interpretation of the results.

The main objective of the test was to determine the suitability of this type of equipment for the coal in question. Further objectives were to determine, insofar as reasonably possible with the small quantity of fuel available, (1) if the coal would carry heavy loads; (2) responsiveness to load changes; (3) character of ash and clinker; (4) possible length of time between cleanings; (5) nature of fly-ash and carbon carry-over; (6) any special handling features or firing technique desirable for the Tantalus Butte coal; all in comparison with the coal normally used.

In general, the results of the test were most encouraging, and were indicative of favourable reactions to the objectives above mentioned. A digest of the data obtained follows:-

I. General

- (1) General condition: Tests made under normal operating conditions applying to the plant.
- (2) Coal normally used: Imported (American), high grade, caking, bituminous, nut slack size with following characteristics:

Screen analysis:

Plus	1½ inch.....	1.7%
"	1¼ ".....	2.7%
"	1 ".....	4.4%
"	¾ ".....	8.4%
"	½ ".....	14.1%
"	⅜ ".....	10.1%
"	¼ ".....	12.6%
"	⅛ ".....	17.3%
"	1/16 ".....	10.9%
"	1/32 ".....	6.9%
Minus	1/32 ".....	10.9%
Average particle size.....		0.424 inches

Proximate analysis:

Moisture.....	4.2%
Ash.....	8.0%
Volatile matter.....	36.2%
Fixed carbon.....	51.6%
Sulphur.....	3.0%
Calorific value as fired.....	13310 B.T.U./lb
Fuel Ratio.....	1.43
Caking properties.....	good-swollen

Ash fusibility:

Initial.....	2040°F.
Softening.....	2140°F.
Fluid.....	2280°F.

- (3) Plant:
- (a) Commercially owned and operated.
 - (b) Condition - excellent, considered to be modern plant of its type, well operated and maintained.
 - (c) Standard operating conditions - 100 lb. gauge feed water temperature 200°F., pressure and feed water level automatically controlled.
 - (d) Steam used for heating and process work.
- (4) Equipment:
- (a) Installed - Fall of 1946.
 - (b) Boiler - "Waterous", horizontal return tubular 66"x14'-0", rated at 100 h.p., set 6'6" floor to shell.
 - (c) Setting - "Plibrico", air cooled steel cased, but heated air not used by forced draft fan.
 - (d) Furnace dimensions - Width 5'3", length 7'6", height of bridge wall and boiler shell above grate line 2'0" and 4'10½" respectively.
 - (e) Stoker - "Foster Wheeler", 20" model 45, Lo-set spreader, with overrunning reel. Electrically driven.
 - (f) Grates - "Foster Wheeler", model 45 hand dumping, 5 section with rear section blanked off, 4 live sections toward front dump in pairs. Total effective area 26 sq. ft.
 - (g) Forced draft fan - Conventional type and size, electrically driven.
 - (h) Feed water pump - "Atlas", 4"x4½", simplex double acting, electrically driven. Feed rate. 1000 gal/hr. at 35 double strokes per minute.
 - (i) Controls - Automatic stop-start by pressure control, feed water level also automatically controlled.
- (5) Test Conditions:
- (a) Coal used determined by measure and estimate of known weights.
 - (b) Water used determined by strokes of feed pump and manufacturer's statement of delivery rate.

- (c) Tests started and ended with coal at same level in feed hopper, and water at same marked point on gauge glass.
- (d) Boiler pressure and feed water temperature determined by readings of plant instruments.
- (e) Smoke and furnace conditions visually gauged.
- (f) Plant load dropped during noon hour. Therefore morning and afternoon tests made on each coal. Boiler tubes cleaned prior to morning tests. Grates cleaned prior to each test.
- (g) As the Tantalus Butte coal had approximately 50% lumps over 1½ inch in size, these were broken down by hand, prior to feeding, to approximate a 1¼ inch slack size.
- (h) General remark - While the method used for determining the efficiency of the boiler is not accurate, it serves as a comparison when making tests under the same identical conditions on two different coals, and for all practical purposes the efficiency ratio should be reasonably close.

II. Observations.

Normal, Nut Slack, Coal						Tantalus Butte 1¼" slack					
Test 1			Test 2			Test 3			Test 4		
Morn. Jan. 19/49			Aft. Jan. 19/49			Morn. Jan. 20/49			Aft. Jan. 20/49		
Time	Pump Strokes	lb. of coal	Time	Pump Strokes	lb. of coal	Time	Pump Strokes	lb. of coal	Time	Pump Strokes	lb. of coal
9:30	start		1:43	start		8:45	start		1:05	start	
9:35	-	260									
9:50	257	-	2:00	234	260	9:00	287	220	1:20	177	364
10:15	314	-	2:15	195		9:10	-	110	1:25	15	84
10:25	410	260	2:25	150	260	9:15	221	110	1:45	451	140
10:55	-	260	2:40	192	-	9:45	324	110	2:05	246	84
11:05	335	-	2:55	204	-	9:55	-	110	2:20	377	112
11:25	254	-	3:10	242	130	10:05	-	110	2:30	151	112
11:30	248	104	3:35	220	-	10:15	284	-	2:40	33	28
11:40	end		3:40	-	130	10:20	-	110			
			3:50	272	-	10:40	350	110			
			4:10	248	130	10:45	-	110			
						10:55	340	-			
						11:00	-	110			
						11:15	-	110			
						11:20	-	110			
						11:40	314	-			
						11:45	144	110			
2.17 hrs	1818	884	2:45 hrs	1957	910	3.00 hrs	2264	1540	1.58 hrs	1450	924

Average boiler pressure 110 lb sq. in. absolute
 Average boiler feed water temperature 200°F.
 Heat in steam at boiler outlet = 1188 - (200-32) = 1020 B.T.U./lb.
 Determined calorific value of normal coal, as fired = 13310 B.T.U./lb.
 Determined calorific value of Tantalus Butte Coal, as fired = 11500 B.T.U./lb.

III. Comparative Results.

Test number.....	1 & 2	3 & 4
Name of coal.....	Normal Nut slack	Tantalus Butte 1 $\frac{1}{4}$ " slack
Length of test.....hrs	4.62	4.58
Ave boiler pressure.....lb sq.in.abs	110	110
Ave feed water temperature.....°F.	200	200
Heat in steam produced.....B.T.U/lb	1020	1020
Calorific value of coal as fired.....B.T.U/lb	13310	11500
Steam produced, total.....lb	17976	17686
Steam produced per hour.....lb	3891	3862
Steam produced per lb of coal used...lb	10.0	7.2
Coal used, total.....lb	1794	2464
Coal used per hour.....lb	388	538
Coal used per 1000 lb. of steam pro- duced.....lb	99.8	139.3
Coal consumption ratio.....	1	1.40
Coal used per sq. ft. grate per hr...lb	14.9	20.7
Heat release per sq.ft.grate per hr. .....B.T.U/lb	198626	237848
Average load carried.....%	108	107
Average overall boiler efficiency.....%	76.8	63.7

IV. Summary

Based on the small quantity of coal available for the test, and such visual observation as was possible during the short period of burning, the equipment would appear to be quite suitable for application to this coal. A heat release of 300,000 B.T.U. per square foot of grate per hour should be quite safe, with a limitation in this regard at about the 350,000 B.T.U. mark, without undue trouble from clinker and slag. However, more prolonged and continuous operation under severe and varying load conditions, is necessary to determine the actual limitations in this and other regards.

The coal gave a longflaming, hot fire and was responsive to load changes; but due to its dryness and large slack content was noticeably dirtier to handle than the coal normally used. The fly carry-over appeared to be somewhat greater and more finely divided than for the normal coal, and for various reasons it is believed that the overall carbon loss will be the higher; but smoke conditions were about the same for both coals and not objectionable at any time. The clinker was of a porous nature, reasonably friable, and caused no trouble in the fire and the length of time between necessary fire cleanings should not be unduly short. No special handling or firing technique, over that in current use with this type of equipment, should be necessary as judged by overall performance and spot checks of exit gas temperatures and composition which were reasonably satisfactory. The overall efficiency was lower than for the normal coal with consequent increased fuel consumption per unit of steam produced, but this may be improved over that reported above if special attention is given to basic design of plant.

CONCLUSIONS

With the Tantalus Butte coal, represented by the foregoing samples, cannot be considered first grade bituminous coal as judged by Eastern Standards, it favourably compares with the non-caking bituminous coals of Western Canada. As the latter are successfully used as a general purpose fuel within their respective markets, it also should be as satisfactory in this regard. From the burning tests made to date, it is apparent that its friable nature with tendency to contain an unduly high proportion of fines under $\frac{1}{2}$ inch in size is the chief factor causing concern to prospective users. Notwithstanding this unfavourable characteristic, satisfactory results should ensue provided the grades of coal within the mine's ability to supply are properly applied to various consumer uses.

For domestic hand fired use, it would be advisable to supply the coal in as lumpy a form as reasonably possible, with the added proviso that the user rake out the fines under $\frac{1}{2}$ inch in size as the coal is used. These fines may be used later for banking purposes. Also, that the coal should be fired in small progressive charges rather than a lot at one time, and that the fire should be handled as for the most troublesome high volatile coals; i.e. alternate side to side, front to rear, and/or new method firing, always leaving a bright spot exposed on top. This is most easily accomplished in shallow firebox types of equipment such as ranges and cook stoves and in the larger sizes of space heaters which normally carry deep fuel beds.

Because of the coal's hybrid nature, which makes it a more suitable one for overfeeding than underfeeding, it is not believed good for use in the conventional type of domestic underfeed stoker. However, if ideal conditions are not mandatory, the coal can be so used but an alternate style of burner head with additional air openings to the hearth side of the retort would be the more desirable. In either case, high fly carry-over and dirt will necessitate more frequent cleaning of the heater sections and furnace room than applies to coal better suited to underfeed use.

For industrial use, best results should ensue when the coal is mechanically fired in thin layers. This implies use of the slack sizes by overfeed, rather than underfeed, firing methods. Good test results were obtained in a conventional horizontal return tubular steam boiler fitted with spreader stoker, forced draft, and hand dumping grates; and competent, independent opinion verifies the conclusion that this type of equipment should be satisfactory for this coal. Also, where extreme service is not required, the hand fired use of the mine run size is feasible provided the necessary precautions are taken with furnace design and preference, if any, is given to forced draft and the use of suitable grates.

This preliminary study indicates that, if the coal is required for general utility purposes, the mine should be prepared to supply coal in at least three grades: (1) a double or single screened lump for hand fired domestic purposes, say $1\frac{1}{2}$ inch and larger; (2) a slack size minus $1\frac{1}{2}$ inch for mechanically fired steam plants; and (3) a mine run size for such hand fired commercial plants as are prepared to use it.

DIVISION OF FUELS

Report No. 7343

FUEL RESEARCH LABORATORIES

Ottawa, June 17, 1948

CANADA
BUREAU OF MINES
REPORT OF ANALYSIS
OF
COAL, COKE OR OTHER SOLID FUEL

Two samples of coal from Tantalus Butte Mine submitted by the Yukon Coal Co., Ltd., Carmacks, Y.T. as per letter of April 3, 1948 from Mr. George Miller to Director, Mines, Forests and Scientific Services, viz.

No. 1 - Channel Sample 100' down the slope - width of 10.9' - (120 lb).

No. 2 - " " 236' down the slope - " " 9.3' - (110 lb).

Laboratory No.		29841		29842	
Sample Mark		No. 1		No. 2	
Moisture Condition		As Rec'd	Dry Basis	As Rec'd	Dry Basis
Proximate Analysis:					
Moisture,	%	4.1		4.7	
Ash,	%	11.5	12.0	12.1	12.7
Volatile Matter,	%	33.4	34.9	31.7	33.3
Fixed Carbon	%	51.0	53.1	51.5	54.0
(by difference)					
Ultimate Analysis:					
Sulphur,	%	0.5	0.5	0.3	0.4
Nitrogen,	%				
Calorific Value:					
B.T.U. per lb, gross		12030	12540	11780	12360

Caking Properties, (judged by residue from volatile- matter determination)	Poor Coke	Poor Coke
Softening temperature of ash (F.P.A.) °F	2250	2150

Screen Analysis (Round-hole screens)

On 4" thru 6"		
" 1 1/2"	" 4"	14.0%
" 1 1/2"	" 1 1/2"	28.0%
" 1/8"	" 1/2"	32.0%
" 1/8"	" 1/8"	26.0%

Remarks:

The analyses of these two samples with ash contents 11 1/2% and 12%, with corresponding calorific values of roughly 1200 and 11800 B.T.U. per lb., respectively, agree closely with the values for the better channel samples submitted in July 1947. In comparison with the previous samples, however, the Caking Properties have become more pronounced. They are to be classed as high volatile "C" bituminous coals similar to coal from the Saunders and Coalspar areas in Alberta.

With considerably over half passing the 1/2 inch screen this coal is to be considered quite friable. However, the larger lumps appear to be suitable as domestic fuel, and either the 1 1/2 inch slack, or run-of-mine coal (with low sulphur content) may be considered suitable for steam raising purposes.

Reported by R. J. Young

"R. E. Gilmore"
Chief of Division

Aug. 20, 1958

Alberta Research Council,
87 Ave. - 114 Street,
Edmonton, Alberta.

Dear Sirs:

We are sending you six samples of coal of which we would like to know the individual coking qualities. Would you kindly make a proximate analysis covering the B.t.u. value, etc. of each sample along with the coking tests.

The charges for these tests are to be made to United Keno Hill Mines Limited, Elsa, Y.T. and referred to Mr. L.T. Chisholm, our Purchasing Agent.

Yours very truly,

UNITED KENO HILL MINES LIMITED

A. H. MANIFOLD,
Chief Geologist.

AHM/m.



RESEARCH COUNCIL OF ALBERTA

87TH AVENUE AND 114TH STREET
EDMONTON, ALBERTA, CANADA

August 26, 1958.

Mr. A.H. Manifold,
Chief Geologist,
United Keno Hill Mines Ltd.,
ELSA, Yukon Territory.

Dear Mr. Manifold,

We have your letter of August 20th in which you state that you are sending six samples of coal for proximate analysis, B.t.u. value and coking tests. In regard to the coking properties, we can perform the Free-Swelling Index test, ASTM Designation: D720-46. Quoting ASTM: "a small-scale laboratory test for obtaining information regarding the free-swelling properties of a coal; the results may be used as an indication of the coking characteristic of the coal when burned as a fuel. This test is not recommended as a method for the determination of expansion of coals in coke ovens."

Would you please advise us at your earliest convenience if the Free-Swelling Index test along with the proximate analysis and B.t.u. value would be satisfactory to you.

Yours very truly,

A handwritten signature in cursive script that reads "J. F. Fryer".

J. F. Fryer.

JFF/mt

Aug. 29, 1958.

Mr. J. F. Fryer,
Research Council of Alberta,
87th Ave. & 114 Street,
Edmonton, Alberta.

Dear Sir:

We do not think the Free-Swelling Index test would be
satisfactory.

Yours very truly,

UNITED KENO HILL MINES LIMITED

A. H. MANIFOLD,
Chief Geologist.

AHM/m.

TELEGRAM INWARD

FROM EDMONTON

TO A. H. MANIFOLD

DATED SEPTEMBER 12th, 1958

DATE RECEIVED

MESSAGE AS RECEIVED

RECEIVED SAMPLES STOP CAN MAKE SIX POUNDS COKE IN LABORATORY FURNACE
TEMPERATURE EIGHT FIFTY DEGREES CENTIGRADE SENT TO YOU TOTAL INCLUDING
PROXIMATE ANALYSIS BTU COKE ONE EIGHTY NINE DOLLARS ADVISE IMMEDIATELY IF
SATISFACTORY

J. F. FYRER
RESEARCH COUNCIL OF ALBERTA
87th Avenue and 114th Street

TELEGRAM OUTWARD

NR.

MESSAGE AS SENT

SEPTEMBER 13th, 1958

MR. J.F. FRYER
RESEARCH COUNCIL OF ALBERTA
87th AVENUE and 114th STREET
EDMONTON ALBERTA

REURTEL PROCEED WITH COAL ANALYSIS AND COKING TESTS AT TOTAL OF ONE EIGHTY NINE
DOLLARS IF TESTS SUITABLE TO DETERMINE THE COKING QUALITIES OF THE SIX COAL
SAMPLES STOP LETTER IN MAIL

A. H. MANIFOLD ✓
U.K.F.M.

M

c.c. C.D.H. Taylor

TRANSLATION

September 13th, 1958.

Mr. J. F. Fryer,
Research Council of Alberta,
87th Avenue and 114th Street,
EDMONTON, Alberta.

Dear Mr. Fryer:

With reference to your telegram to Mr. A. H. Manifold and to our night letter to you dated September 13th, the six samples which you have received are from various coal seams in this district.

We are looking for a coal of suitable characteristics to make coke for smelting purposes.

We have authorized you to make analyses of these six samples, also test as to the coking qualities of each sample at a total cost of \$189.00 as per your telegram.

If, however, your laboratories are not equipped to make suitable tests as to the coking qualities, we should appreciate it if you would forward the coal samples to the Government Testing Laboratory in Ottawa at our expense.

Please advise.

Yours very truly,

UNITED KENO HILL MINES LIMITED

C. D. N. Taylor
Assistant Manager

GDNT/dc

c.c. A.H. Manifold ✓

TO Mr. A. E. Pike

DATE October 7th, 1958

ADDRESS Elsa, Y. T.

FROM A. H. Manifold

IN REPLY TO YOURS OF _____

ADDRESS Calumet, Y. T.

SUBJECT Coal Investigation - Carmacks Area, Y. T.

On August 1st and 2nd Mr. C.D.N. Taylor and the writer visited the Tantalus Butte coal mine and vicinity to take samples of any coal seam in the area and have its coking qualities checked.

A total of six samples were taken and sent to the Research Council of Alberta, Edmonton for analysis. Their tests indicated that none of the coals was suitable for making coke.

Following is a description of the samples, the location from which they were taken, and a table of the testing results.

Sample 1 was fresh coal from the north section of the commercial seam at the Tantalus Butte mine presently being operated. This seam is from 7 to 14 feet thick striking almost north-south and dipping approximately 45° to the west.

Sample 2 was from a non-commercial seam 2 to 3 feet thick, in the hanging wall of the area where sample 1 was obtained.

Sample 3 was fresh coal from the south section of the Commercial seam at the Tantalus Butte mine.

Sample 4 was from a dump at the Tantalus mine located on the south side of the Yukon River at Carmacks. This dump has likely been exposed for 20 years or more. The mine workings have caved and no outcrop of the coal seams was found. In the immediate vicinity of the coal the sandstones and conglomerates strike N 20 W and dip 45° to the east.

Sample 5 was from a dump at the Five Fingers mine located on the east side of the Yukon River about five miles above Five Fingers Rapids. The workings are in the lower slope of the river bank which at this point is at least 500 feet high consisting of unconsolidated sand and clay. Access was impossible and no rock or coal outcrop was found. The coal obtained for testing had been exposed for more than 30 years.

Sample 6 was from a coal seam on the Nelson group of claims south of Carmacks. This property was not visited.

.....2

Coal Analysis Report

		<u>Proximate Composition</u>				<u>Calorific Value</u>	
<u>Sample</u>		<u>Moisture</u>	<u>Ash</u>	<u>Volatile Matter</u>	<u>Fixed Carbon</u>	<u>Nature of Coke</u>	<u>Gross B.T.U. Per lb.</u>
1	R	2.6	11.5	33.4	52.5	Barely	12220
	D	0.0	11.8	34.3	53.9	agglomerating	12550
2	R	2.9	39.3	26.3	31.3	Barely	7970
	D	0.0	40.5	27.3	32.2	agglomerating	8200
3	R	2.8	15.1	32.9	49.2	Barely	11390
	D	0.0	15.5	33.9	50.6	agglomerating	11710
4	R	1.4	59.4	15.8	23.4	Non	4900
	D	0.0	60.2	16.1	23.7	agglomerating	4900
5	R	6.0	23.7	31.0	39.3	Non	9480
	D	0.0	25.3	33.0	41.7	agglomerating	10080
6	R	5.3	13.0	14.2	67.5	Non	11640
	D	0.0	13.7	15.0	71.3	agglomerating	12290

R - As received basis % by weight
D - Dry basis % by weight

In reference to Memoir 189 of the Geological Survey a number of analyses were reported on the Tantalus Butte coal seams. These would compare to samples 1, 2 and 3 in the above table. D. D. Cairnes reported none of the 3 samples gave a coherent coke. In 1933 and 1934 H. S. Hestock and A. R. Johnstone reported all of 8 samples as being agglomerating.

In view of the results received from the Research Council of Alberta it can be concluded none of the coals in Carmacks area will produce a good coke.

Respectfully Submitted

A. E. Manifold

c.c. C.D.N. Taylor



RESEARCH COUNCIL OF ALBERTA

87TH AVENUE AND 114TH STREET
EDMONTON, ALBERTA, CANADA

September 29th, 1958.

Mr. C. D. N. Taylor,
Assistant Manager,
United Keno Hill Mines Ltd.,
Elsa, Yukon Territory.

Dear Mr. Taylor:

We have analyzed the six samples of coal submitted by you. The volatile matter test indicated that your sample Nos. D604, D605 and D606 would not coke at all but that Nos. D601, D602 and D603 might warrant further tests. Accordingly, these three coals were tested in a pilot-plant size coking apparatus (about 10 lbs. of coal being used). These tests indicated that none of the coals was suitable for making coke. Our charges will be less than \$189 as indicated since it was necessary to test only three of the coal samples in the coking apparatus.

I am sending you the analyses of the six samples and will send you the solid products from the three coking tests if you request them.

Yours very truly,

Per. J. F. Fryer
J. F. Fryer.

JFF/lis

COAL ANALYSIS REPORT

File No.

Laboratory
Sample No.

559-58

MINE:

OPERATOR:

LOCATION:

ADDRESS:

DESCRIPTION OF SAMPLE: Sample of coal from United Keno Hill Mines Ltd.

SAMPLER: A.H. Manifold

DATE OF SAMPLING:

SAMPLER'S NO.: D601, Can #61

DATE RECEIVED: September 10, 1958

AIR DRY LOSS PER CENT

PROXIMATE COMPOSITION:	As Analyzed % by Wt.	Capacity Moisture Basis % by Wt.	As Received Basis % by Wt.	Dry Basis % by Wt.
Moisture			2.6	0.0
Ash			11.5	11.8
Volatile Matter			33.4	34.3
Fixed Carbon			52.5	53.9
Nature of Coke		Barely agglomerating		
Colour of Ash				
ULTIMATE COMPOSITION:				
Carbon				
Hydrogen				
Sulphur				
Nitrogen				
Moisture				
Ash				
Difference (oxygen, undetermined and errors)				
Calorific Value, gross B.T.U. per lb.....			12220	12550
Calorific Value, net B.T.U. per lb.....				
Fuel Ratio (F.C./V.M.)				
Carbon/Hydrogen Ratio				
Free Swelling Index				
Caking Index				
Fusion temperature of coal ash, °F				

REMARKS:

Date..... September 29, 1958

Signed.....

Approved.....

J. J. Jensen
M. A. Lang

RESEARCH COUNCIL OF ALBERTA

UNIVERSITY OF ALBERTA

COAL ANALYSIS REPORT

File No.

Laboratory
Sample No.

560-58

MINE:

OPERATOR:

LOCATION:

ADDRESS:

DESCRIPTION OF SAMPLE: Sample of coal from United Keno Hill Mines Ltd.

SAMPLER: A.H. Manifold

DATE OF SAMPLING:

SAMPLER'S NO.: D602, Can #57

DATE RECEIVED: September 10, 1958

AIR DRY LOSS PER CENT

PROXIMATE COMPOSITION:	As Analyzed % by Wt.	Capacity Moisture Basis % by Wt.	As Received Basis % by Wt.	Dry Basis % by Wt.
Moisture			2.9	0.0
Ash			39.3	40.5
Volatile Matter			26.5	27.3
Fixed Carbon			31.3	32.2
Nature of Coke		Barely agglomerating		
Colour of Ash				
ULTIMATE COMPOSITION:				
Carbon				
Hydrogen				
Sulphur				
Nitrogen				
Moisture				
Ash				
Difference (oxygen, undetermined and errors)				
Calorific Value, gross B.T.U. per lb.....			7970	8200
Calorific Value, net B.T.U. per lb.....				
Fuel Ratio (F.C./V.M.)				
Carbon/Hydrogen Ratio				
Free Swelling Index				
Caking Index				
Fusion temperature of coal ash, °F				

REMARKS:

Date September 29, 1958.

Signed

Approved

[Handwritten signatures]

RESEARCH COUNCIL OF ALBERTA

UNIVERSITY OF ALBERTA

COAL ANALYSIS REPORT

File No.

Laboratory
Sample No.

561-58

MINE:

OPERATOR:

LOCATION:

ADDRESS:

DESCRIPTION OF SAMPLE: Sample of coal from United Keno Hill Mines Ltd.

SAMPLER: A.H. Manifold

DATE OF SAMPLING:

SAMPLER'S NO.: D603, Can #54

DATE RECEIVED: September 10, 1958

AIR DRY LOSS PER CENT

PROXIMATE COMPOSITION:	As Analyzed % by Wt.	Capacity Moisture Basis % by Wt.	As Received Basis % by Wt.	Dry Basis % by Wt.
Moisture			2.8	0.0
Ash			15.1	15.5
Volatile Matter			32.9	33.9
Fixed Carbon			49.2	50.6
Nature of Coke		Barely agglomerating		
Colour of Ash				
ULTIMATE COMPOSITION:				
Carbon				
Hydrogen				
Sulphur				
Nitrogen				
Moisture				
Ash				
Difference (oxygen, undetermined and errors)				
Calorific Value, gross B.T.U. per lb.....			11390	11710
Calorific Value, net B.T.U. per lb.....				
Fuel Ratio (F.C./V.M.)				
Carbon/Hydrogen Ratio				
Free Swelling Index				
Caking Index				
Fusion temperature of coal ash, °F				

REMARKS:

Date September 29, 1958

Signed

Approved

E. J. Jensen
W. B. Lang

COAL ANALYSIS REPORT

File No.

Laboratory
Sample No.

562-58

MINE: OPERATOR:

LOCATION: ADDRESS:

DESCRIPTION OF SAMPLE: Sample of coal from United Keno Hill Mines Ltd.

SAMPLER: A.H. Manifold

DATE OF SAMPLING:

SAMPLER'S NO.: D604, Can #62

DATE RECEIVED: September 10, 1958

AIR DRY LOSS PER CENT

PROXIMATE COMPOSITION:	As Analyzed % by Wt.	Capacity Moisture Basis % by Wt.	As Received Basis % by Wt.	Dry Basis % by Wt.
Moisture			1.4	0.0
Ash			59.4	60.2
Volatile Matter			15.8	16.1
Fixed Carbon			23.4	23.7
Nature of Coke		non-agglomerating		
Colour of Ash				
ULTIMATE COMPOSITION:				
Carbon				
Hydrogen				
Sulphur				
Nitrogen				
Moisture				
Ash				
Difference (oxygen, undetermined and errors)				
Calorific Value, gross B.T.U. per lb.....			4900	4900
Calorific Value, net B.T.U. per lb.....				
Fuel Ratio (F.C./V.M.)				
Carbon/Hydrogen Ratio				
Free Swelling Index				
Caking Index				
Fusion temperature of coal ash, °F				

REMARKS:

The calorific value is rounded off to the nearest hundred B.t.u. since the calorific value varied greatly in this high ash coal.

Date September 29, 1958.

Signed *D. J. Keenan*

Approved *M. P. Lang*

COAL ANALYSIS REPORT

File No.

Laboratory
Sample No.

563-58

MINE:

OPERATOR:

LOCATION:

ADDRESS:

DESCRIPTION OF SAMPLE: Sample of coal from the United Keno Hill Mines Ltd.

SAMPLER: A.H. Manifold

DATE OF SAMPLING:

SAMPLER'S NO.: D605, Can #50

DATE RECEIVED: September 10, 1958

AIR DRY LOSS PER CENT

PROXIMATE COMPOSITION:	As Analyzed % by Wt.	Capacity Moisture Basis % by Wt.	As Received Basis % by Wt.	Dry Basis % by Wt.
Moisture			6.0	0.0
Ash			23.7	25.3
Volatile Matter			31.0	33.0
Fixed Carbon			39.3	41.7
Nature of Coke		non-agglomerating		
Colour of Ash				
ULTIMATE COMPOSITION:				
Carbon				
Hydrogen				
Sulphur				
Nitrogen				
Moisture				
Ash				
Difference (oxygen, undetermined and errors)				
Calorific Value, gross B.T.U. per lb.....			9480	10080
Calorific Value, net B.T.U. per lb.....				
Fuel Ratio (F.C./V.M.)				
Carbon/Hydrogen Ratio				
Free Swelling Index				
Caking Index				
Fusion temperature of coal ash, °F				

REMARKS:

Date September 29, 1958.

Signed

Approved

E. J. Jensen
A. H. Manifold

COAL ANALYSIS REPORT

File No.

Laboratory
Sample No.

564-58

MINE: OPERATOR:

LOCATION: ADDRESS:

DESCRIPTION OF SAMPLE: Sample of coal from the United Keno Hill Mines Ltd.

SAMPLER: A.H. Manifold

DATE OF SAMPLING:

SAMPLER'S NO.: D606, Can #34

DATE RECEIVED: September 10, 1958

AIR DRY LOSS PER CENT

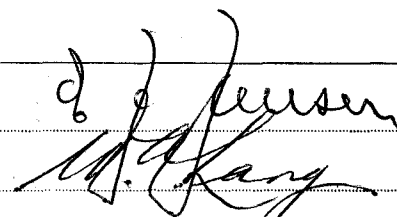
PROXIMATE COMPOSITION:	As Analyzed % by Wt.	Capacity Moisture Basis % by Wt.	As Received Basis % by Wt.	Dry Basis % by Wt.
Moisture			5.3	0.0
Ash			13.0	13.7
Volatile Matter			14.2	15.0
Fixed Carbon			67.5	71.3
Nature of Coke				
Colour of Ash				
ULTIMATE COMPOSITION:				
Carbon				
Hydrogen				
Sulphur				
Nitrogen				
Moisture				
Ash				
Difference (oxygen, undetermined and errors)				
Calorific Value, gross B.T.U. per lb.....			11640	12290
Calorific Value, net B.T.U. per lb.....				
Fuel Ratio (F.C./V.M.)				
Carbon/Hydrogen Ratio				
Free Swelling Index				
Caking Index				
Fusion temperature of coal ash, °F				

REMARKS:

Date: September 29, 1958.

Signed

Approved



RESEARCH COUNCIL OF ALBERTA

87th Avenue and 114th Street

Edmonton, Alberta

Report of Analyses

The following are the analyses of samples of coal submitted by United Keno Hill Mines Ltd.,
Elsa, Yukon Territory.

Your Designation: Coal Sample

Date Sample Taken:

Laboratory Sample No.: 433-60

		<u>As Received</u>	<u>Dry</u>	<u>As Received</u>	<u>Dry</u>
Moisture	%	3.0	0.0		
Ash	%	9.6	9.9		
Volatile Matter	%	35.1	36.1		
Fixed Carbon	%	52.3	54.0		
Sulfur	%				
Calorific Value, B.t.u. per lb.		12,200	12,580		
Free Swelling Index		1			

Remarks:

This sample of coal was tested for coking properties by the Free Swelling Index test. The test indicated that the coal was barely agglomerating.

Date: April 11, 1960.

Signed: *H. J. Johnson, Jr.*

Coal Analytical Laboratory

Approved: *J. F. Fryer*

TO W. Hibbert
 ADDRESS _____
 IN REPLY TO YOURS OF _____
 SUBJECT General Interest

DATE Dec 18/63
 FROM W.D. Hogan
 ADDRESS Genl

The following will be of interest to you.
 W Sample for the month of October from the man at Room 16

	<u>Ev Dried</u>	<u>As Rec'd.</u>
Air-drying Loss	3.00%	4.54%
Moisture	1.59%	30.60%
Volatile Matter	31.55%	53.10%
Fixed Carbon	54.74%	11.76%
Ash	12.12%	0.41%
Sulphur	0.42%	11,995
B.T.U. per lb	12,366	
Caking Qualities	<u>Caking</u>	
Color of Ash	Grey	

II Sample from #5 pillar Outside

Air Drying Loss	5.75%	12.77%
Moisture	7.45%	26.21%
Volatile Matter	27.81%	48.83%
Fixed Carbon	51.81%	12.19%
Ash	12.93%	0.31%
Sulphur	0.33%	9,695
B.T.U. per lb	10,287	
Caking Qualities	Non-caking	
Color of Ash	Light Brown	

THE RALPH M. PARSONS COMPANY

INTEROFFICE CORRESPONDENCE

Date November 30, 1965

To Robert Lillie (New York)

From Ray Jenkins

SUBJECT Job 3746-1 - Anvil Project
Coal Samples

Samples taken from the Yukon Coal Company main haulage face were taken in the same sample channel cut by Mr. Oliver for the sample results given us in Whitehorse.

The samples are tagged as follows:

Hanging Wall

A-1 - 1'-10" Hanging wall coal.
A-2 - 3'-10"
A-3 - 1'-5" Some dirt and bone.
A-4 - 4'-3"
A-5 - 2'-6 $\frac{1}{2}$ " Some inert material included.

Footwall

Dip 58°

True thickness sampled is normal to dip.

Mr. Hibbert will take some 100 samples from upper faces in the mine when we request them.


Ray J. Jenkins

RWJ:cl

CC: W. K. Brown (Cyprus Mining Co., 3 copies)
J. D. Evans
M. C. Rote/J. K. Shippey
S. Umbenhauer

MATS OTTAWA

27/4/66

FOR A D OLIVER
RESIDENT MINING INSPECTOR

REGRET DELAY IN REPLYING TO YR LETTER APRIL 6 MR IGNATIEFF AND MR TIBBETTS
BOTH ABSENT. BEST METHOD OF PRELIMINARY SAMPLING DIAMOND DRILL CORES FROM
ROOF TO FLOOR OF SEAM OXIDATION DESTROYS COOKING PROPERTIES SAMPLE
SHOULD BE TAKEN WELL IN FROM OUTCROP WHERE COAT NOT EXPOSED TO OXIDIZING
GROUND WATER. SOMETIMES HAVE TO GO IN 30 FT FROM FACE TEST METHOD
ASTM 720-57 REPORT ON FIELD METHOD FOLLOWING. SUGGEST INITIAL
CORES BE SENT HERE AIR FREIGHT FOR INITIAL INSPECTION. IF SWELLING
PROPERTIES OK ASH OK WILL RECOMMEND TRENCH SAMPLE FOR BENCH SCALE
COKING TEST WE CAN DO 15 TO 20 SWELLING TESTS PER DAY EVALUATION OF CORE SAMPLES
ONE WEEK FROM RECEIPT OF SAMPLES IN OTTAWA BENCH SCALE TESTS REQUIRE 100
POUNDS IF OK FINAL TEST IN 500 POUND OVEN LETTER FOLLOWING

MZ

RECEIVED
MATS OTTAWA
APR 28 1966

Fuels and Mining Practice
Division

562 Booth Street
Ottawa 1, Ontario
May 6, 1966

Mr. A. D. Oliver
Resident Mining Inspector
Department of Northern Affairs and
National Resources
Box 2703
Whitehorse, Yukon Territory

Dear Mr. Oliver:

I regret the delay in answering your letter of April 6th owing to quite a long absence from the office.

Dr. Montgomery, in the meantime, has wired you in regard to swelling and caking tests. The recommendations are particularly applicable to evaluation of virgin coal deposits.

We are somewhat puzzled by your letter in relation to the location of the coal deposit of interest to the Anvil Mining Corporation. I was under the impression when you visited us here that you had in mind the Tantalus Butte mine or was it the old Carmacks mine? If this is so, swelling tests which are indicative of caking properties only are not required unless unexplored sections of seams are involved. A sample from a freshly exposed mine or prospect face is what is required to establish by oven test whether a coherent coke or a char will be produced. Six hundred pounds of sample will enable us to conduct a Bethlehem oven and movable wall oven test.

An important caution in dealing with all coking coal samples was contained in Dr. Montgomery's telegram, namely, the importance of insuring that the samples are fresh and not affected by oxidation.


.....Continued

May 6, 1966

2 -- Mr. A. D. Oliver

Please advise us further on the matter.

Yours very truly,


A. Ignatieff, Chief
Fuels and Mining Practice
Division

✓ AT:psr

cc Mr. Robert Thurmond


M E M O R A N D U M

To: R. E. Thurmond
From: C. H. Macdonald
Date: May 11th 1966
Subject: COAL INVESTIGATION

Ad Oliver was in the office yesterday with wire from Ottawa and this a.m. we have copy of letter from Fuel Testing Bureau, Ottawa, copy attached for your approval. To provide the necessary samples we will authorize Bob Cathro to get these along with his work at Carmacks.

1. We will require 3 samples from present Tantalus Butte Seam as exposed in Yukon Coal Co-working. Each sample approximately 1,200# from fresh face and top, middle and bottom of seam. These to be sealed in plastic bags.

2. Will also suggest that Cathro investigate possibility of underground drilling from Yukon Coal Company Workings to investigate possible H.W. and Floor seams. We will discuss this with U.K.H.M. personnel, obtain estimate of cost (presume our drill equipment available from U.K.H.M.). I think these are fairly short holes and Oliver advises core would be suitable for swelling tests for coking possibilities.


C. H. Macdonald
PROJECT MANAGER

Enc:



Department
of Northern Affairs
and National Resources Resource Development
Branch

Ministère
du Nord canadien et
des Ressources nationales Direction du développement
des ressources

RAM

Box 2703,
Whitehorse, Yukon,
May 12, 1966.

our file / notre dossier
your file / votre dossier

Mr. A. Ignatieff,
Chief, Fuels and Mining Practice Division,
562 Booth Street,
Ottawa 1, Ontario
May 6, 1966

Dear Mr. Ignatieff:

I wish to thank you and Dr. Montgomery for the information supplied in the telex and your recent letter.

I am sorry there is some confusion over the coal deposits in which the Anvil Mining is interested and I will try to explain.

The company has retained a consulting firm in Whitehorse to pick out areas which may contain coal with coking properties. As you know work done in the early 1900's indicates there may be coking coal occurring in the seams of the old Tantalus Mine south of the river and at the Five Finger Mine down stream from Carmacks. A Geological investigation is now being carried out in these areas, in the Big Salmon area, and other potential areas containing the Tantalus formation. This investigation will determine targets for a future drilling program.

In the meantime Anvil are making arrangements with the management of the Yukon Coal Co. to take additional samples from the present Tantalus Butte Mine. Anvil is also considering drilling a diamond drill hole in the footwall and hanging wall of this seam.

As discussed by your officers while I was in Ottawa, samples will be taken from the top part of the seam, middle part of the seam and bottom of the seam. Each sample will consist of 1200 lbs. to allow coking tests on the natural coal on a washed sample, or whatever procedure you may want to follow. I understand that various techniques can be used to improve the coking qualities of some coals. Perhaps you may advise if any new techniques may be used after testing the samples.

.....continued



Department
of Northern Affairs
and National Resources Resource Development
Branch

Ministère
du Nord canadien et
des Ressources nationales Direction du développement
des ressources

our file / notre dossier
your file / votre dossier

- 2 -

In further discussions with Anvil, it was decided that they would establish direct communication with your division in the future, but I would appreciate being kept in the picture by copies of the results of any testing so as to complete my files.

I wish to thank you for your interest in this matter, and trust that this letter makes the program for exploration for coking coals a little more clear.

Yours truly,
A.D. Oliver
A.D. Oliver.

ADO/jw

cc: C. MacDonald,
Anvil Mining Co.,
Box 2470,
Whitehorse, Yukon

ARCHER & CATHRO

CONSULTING GEOLOGICAL ENGINEERS

P.O. Box 1051
WHITEHORSE

May 17, 1966

Mr. C. H. MacDonald,
Project Manager,
Anvil Mining Corp. Ltd.,
Whitehorse.

Dear Sir:

Re: Channel Sampling- Tantalus Butte Mine

On May 17, 1966, Mr. A.D. Oliver and I visited the Tantalus Butte Mine of the Yukon Coal Co. Ltd. A bulk channel sample was cut across the face of the Main Entry which had been freshly exposed the previous day.

The seam at that point has a true thickness of slightly over twelve feet and dips 58 degrees west. The seam shows no natural partings and was arbitrarily divided into three portions for sampling purposes, each four feet long (see Figure I).

The channel averaged 28 inches wide and 16" deep. A single sample was cut from each four foot portion and randomly placed into four plywood boxes. In all, twelve boxes were filled, each measuring 3'x2'x1' and weighing between 250 and 300 pounds. The total weight of sample is thus about 3500 pounds, sufficient for both raw and washed tests. Each sample was completely enclosed in heavy plastic film. On the outside of each box the sample number and an arrow pointing upwards are marked on all four sides and the word "top" on the lid, all in black paint.

The location of the twelve samples is as follows:

Hanging Wall

0-4 feet	samples 1 to 4 inclusive
4-8 feet	" 5 to 8 "
8-12 feet	" 9 to 12 "

Footwall

The samples will arrive in Whitehorse *May 19th*
via *White Pass*. Before furtherance each

. 2.

*copy to
A.D. Oliver as
initial letter.*

2.

box should be securely strapped and clearly marked in such a way that the top will always be kept up since the lids are not very secure.

The samling was greatly assisted by the complete cooperation of Mr. Martin Aschacker, Mine Manager.

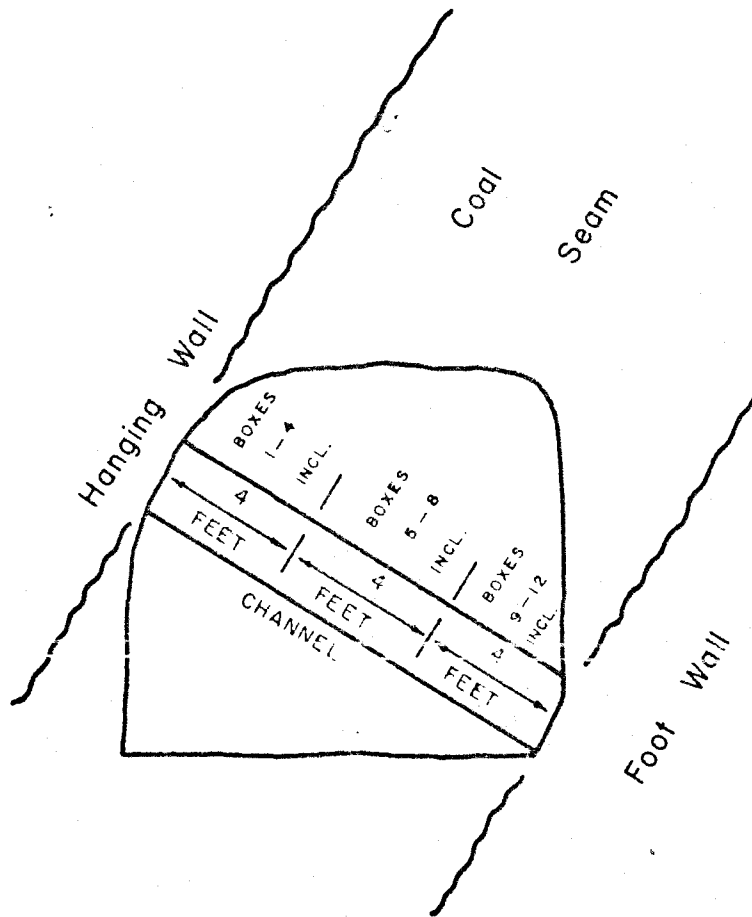
Yours truly,

ARCHER & CATHRO



R.J. Cathro

c.c. A.D. Oliver



Face of Main Entry

LOCATION OF CHANNEL SAMPLE

TANTALUS BUTTE MINE
CARMACKS, YUKON

ARCHER & CATHRO

Consulting Geological Engineers

DATE	17 May 1966
DRAWN	SC
SCALE	1 inch = 5 feet

DWG. No. 1.

ARCHER & CATHRO

CONSULTING GEOLOGICAL ENGINEERS

P.O. Box 1051
WHITEHORSE

May 18, 1966

Mr. William Goodwin,
Manager,
Coleman Collieries Ltd.,
Coleman, Alberta.

Dear Sir:

On behalf of a client, we are investigating the coking coal potential of the Carmacks area, Yukon. Mr. Martin Aschacker, Manager of the Tantalus Butte Mine of the Yukon Coal Co. Ltd., has mentioned to me that your company has had experience in the use of percussion drilling and sludge collection in tracing coal seams on surface.

We would appreciate it very much if you would have a member of your exploration staff drop us a note outlining the techniques used. Mr. Aschacker mentioned the names of Mr. Diskin, Project Engineer, and Mr. Johnson, Geologist. We are particularly interested in-

- a. Whether a percussion or diamond drill sludge sample can be used as a reliable guide to coking quality.
- b. the technique used in collecting the sludge sample and keeping it fresh while enroute to the testing lab.
- c. the usual depth below outcrop necessary to obtain coal suitably fresh for a coking test.
- d. any rapid field test which can be used to determine approximate swelling or coking quality.
- e. whether coking and non-coking coal can ever be distinguished visually.
- f. the variation which can be expected within a single seam, along strike and across the seam between coking and non-coking coal.
- g. any published references on the above questions which might come to mind.

. . . . 2.

*Copy X
MWB
19.7.66*

2.

a
Any experience along these lines which you feel you can pass on to us will be an invaluable help.

Yours very truly,

ARCHER & CATHRO

R.J. Cathro

Cathro & C.

COLEMAN COLLIERIES LIMITED

May 24, 1966.

GENERAL OFFICES AND MINES

COLEMAN,

ALBERTA

Mr. R. J. Cathro,
Archer & Cathro,
Box 1051,
WHITEHORSE, Yukon.

Gentlemen:

In answer to your inquiry of May 18th, regarding exploration methods and techniques for coking coal, we submit the following:

General

There are several factors that affect the specific answers to your questions. These are structure, composition and rank of the coal, and overburden character and depth. Each of these affects the tentative answers given to your specific questions.

(a) Percussion or diamond drill sludge can be used to qualitatively test coking quality of a coal but the sludge is not as accurate as cores, if they can be obtained.

(b) Muslin bags, or cloth flour sacks can be used to filter the returns from the hole, but do not catch all of the vitrain nor clay ash.

(c) Depth below outcrop to fresh coal depends on structure, terraine, and rank of coal. It may be 30 feet to several hundred feet. Oxidation may penetrate even farther and adversely affect coking.

(d) The only field test that can be applied by the average geologist is the Free Swelling Test, or Coke Button index. You should have a copy of ASTM specifications to get index shapes but the test is run in a covered porcelain crucible over a butane or propane burner (not a torch). Non-coking coal will neither swell nor produce a coherent button residue. Coking quality is related to the size and shape of the button.

(e) Some visually distinguishable types of coal are always non-coking, but other types can only be determined by testing. Stained coal generally will not coke. Only bituminous coal in the volatile range of 18 to 40% volatile can be coked under any circumstances.

(f) This is a special field of geology and does not permit a simple answer. The variations can be great. Again structure, cover, rank and terraine are involved.

*Copy to
Mr. Cathro
1970*

Continuation of Letter To R.J.Cathro

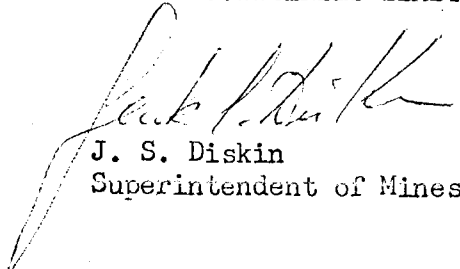
(g) Specifications for testing coal are published by the American Society for Testing Materials (ASTM). This bulletin prescribes procedures to produce standardized test results.

A textbook "Coal" by E.S. Moore gives some coal geology but the discussion on coking is both antiquated and brief. Publisher - John Wiley.

A.S.T.M. Specifications for Coal and Coke is your best reference.

Sincerely,

COLEMAN COLLIERIES LIMITED



J. S. Diskin
Superintendent of Mines

JSD:ck

May 19th 1966

Mr. A. Ignatieff, Chief,
Fuels and Mining Practice Division,
Department of Mines and Natural Resources,
562 Booth Street,
O T T A W A 1, ONTARIO.

Dear Sir:

We are today shipping to you by truck transport 12 boxes of coal samples from the Tantalus Butte mine of Carmacks Coal Company. These samples are from: upper (samples 1-4), middle (samples 5-8), lower (samples 9-12) portions of the main coal seam.

These samples have been taken in accordance with your correspondence with Mr. A. D. Oliver. You will realize that our prime concern is to acquire some up-to-date accurate estimates of the coking properties of the coal in this seam, and in particular if part of the seam only may have coking properties.

Yours truly,

C. H. Macdonald
PROJECT MANAGER

c.c. Robert Collins III
A. D. Oliver
R. D. Cathro



Department of Mines and Technical Surveys
Ministère des Mines et des Relevés techniques

File Number
No à rappeler

Final file

Fuels and Mining Practice
Division

562 Booth Street
Ottawa 1, Ontario
June 3, 1966

Mr. C. H. Macdonald
Project Manager
Anvil Mining Corporation Limited
P. O. Box 2470
103 Polaris Block
Whitehorse, Yukon Territory

Dear Mr. Macdonald:

Thank you for your letter of May 19th and we would advise you that the samples have only reached these laboratories yesterday.

We will carry out a number of tests to determine coking properties and, if these are satisfactory, we will proceed with the scaled up tests for producing coke to evaluate its quality.

Yours very truly,

A. Ignatieff, Chief
Fuels and Mining Practice Div.

AI:sr
cc Mr. A. D. Oliver
Mr. R. D. Cathro ✓

RECEIVED JUN 8 1966



Department
of Northern Affairs
and National Resources

Ministère
du Nord canadien et
des Ressources nationales

*Copy for
R.E.T.
File - Canada Co.*

C.H. MacDonald, Esq.,
Project Manager,
Anvil Mining Corporation Limited,
P.O. Box 2470,
103 Polaris Block,
Whitehorse, Y.T.

Ottawa 4, June 20, 1966.

our file/ notre dossier
your file/ votre dossier

RECEIVED
JUN 23 1966
WHITEHORSE

Dear Colin,

I am enclosing an article out of the "Colliery Guardian", which concerns a method by which friable coal cores are saved intact by using a plastic sheath inside the core barrel.

Mr. Ignatieff, Chief of the Fuels and Mining Practice Division, recommends this method which has been used before successfully. To conduct a proper coking test on a diamond drill core all the coal must be recovered. For example, it may be that using ordinary methods the fines could be lost; however, it is possible that the fines are coking while the remaining coal is not coking. The plastic sheath method is the only way to obtain a good sample in friable coals.

Mr. Ignatieff also spoke of a Mr. J. Patterson, Manager, Smit Connors, Red Deer, Alberta, who has had some experience with the sheath method using a nylon insert. Mr. Patterson has also developed a special core barrel.

I believe that it might be worthwhile to have Bob Cathro look into this further if you plan any drill of the coal seams.

As you know the samples have arrived. The first tests on unwashed samples did not indicate any coking characteristics so I am not hopeful that washing, will improve the coal that much.

Would you please send me a copy of the report Bob Cathro made on taking the sample from the coal mine.

Pass on my thanks to Mostyn Grant for forwarding copies of letters on visit to Whitehorse by U.S.A. Government officials.

Yours sincerely,

A.D. Oliver
A.D. Oliver,
Mining Inspector

Encl.

*P.S. I will be home in Whitehorse next week
see you then.*

Core Handling in Exploratory Drilling

A New Method by Turiff Construction Corporation Ltd.

During recent years Turiff Construction Corporation Ltd., of Warwick, have extended their activities into the drilling field, specialising in proving mineral deposits covering a wide range of drilling in many kinds of hard, medium, soft and friable formations using the most modern drilling techniques. They have particularly specialised in air flush drilling, which, during the last few years, has become increasingly popular throughout the whole of the drilling industry. Originally used for small diameter holes in quarry work, it has now been used even for deep holes in oilfields.

For the comparatively small, i.e. up to 2,000 ft. rig, it has a large number of advantages, mainly:

- (i) A vastly increased rate of penetration.
- (ii) A great increase in bit life.
- (iii) Freedom from the necessity of supplying drilling fluid.
- (iv) The avoidance of washing away when coring soluble material.

Apart from high core recovery obtained by standard modern drilling machines and equipment, Turiff Construction Corporation have invented, patented and developed a method whereby cores are taken directly into a transparent sheath and removed in this container from the core barrel, thus ensuring that the core is preserved in its original state. This is especially useful in soft and friable formations. Sheaths are expendable, easily cut and resealed. The advantage of this method is obvious. Developed originally from using double tube core barrels with 3 in. and 4 in. cores in coal formations, it is possible and usual to measure strata thicknesses to a $\frac{1}{4}$ in. in the most friable formations. The core sheath is tough and absolutely untearable so that cores can be handled or transported without damage.

The difficulty of transferring friable cores from core barrel to box without damage and as near as possible in their original state, has been a problem to all drillers and geologists for many years.

The company's own interest developed whilst working for the Opencast Executive of the National Coal Board, where thickness of seams can often make the difference between a workable and an uneconomic site. Although apart from that, there was a natural annoyance at their inability to produce, in the box, the perfect cores which they knew were in the core barrel.

Experiments started some two and a half years ago, and many different approaches were made, some with a little success, but mostly resulting in failure, before a sheath of plastic material was found to be the solution. Amongst the many ideas considered, tried and rejected were the injection of petrifying liquid, split inner barrels and a large and assorted variety of receivers.

The first experiments with plastic sheaths were not successful, but about this time a polyester film became available, manufactured by I.C.I., and marketed under the trade name of Melinex. Tough, resilient and absolutely untearable even in one thou. gauge, this seemed to offer possibilities. The next problem was to secure it within the inner barrel in such a way that it would be secure during coring but easily removable when required, and this proved the most difficult problem of all. Eventually, a simple collar

and clip were evolved, and used with three thou. or four thou. gauge plastic proved, at first, most satisfactory, cores taken through friable coals and clays proving very good.

By spring of this year, it was thought that this was the answer, but then a serious obstacle arose. Although untearable, Melinex can be pierced fairly easily, and once pierced will rip without difficulty, and as soon as attempts were made to apply this method to cores of abrasive strata, e.g. sandstone, it was found that small particles of core jammed between the barrel and the core itself, ripped the sheath and destroyed it.

Melinex not being available in a thicker gauge, a number of alternatives were tried, but then through I.C.I. a sample of a similar polyester film, manufactured by du Pont and marketed under the trade name of Mylar, was obtained.

A trial sample of this material of 10 thou. gauge was immediately flown in from America, proved 100 per cent. successful, and regular supplies are now being obtained. Unfortunately, Mylar is only manufactured in its fully transparent form up to 7.5 thou. in thickness; above that one side is translucent, and although this is not of vital importance, supplies of the

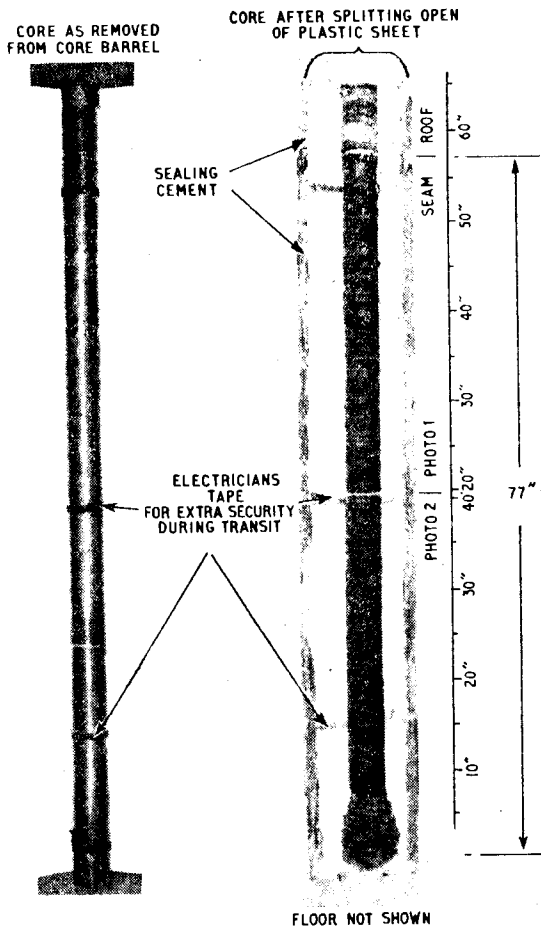


Fig. 1 (Left).—Typical core as removed from core barrel.
(Right): Core after splitting open of plastic sheet

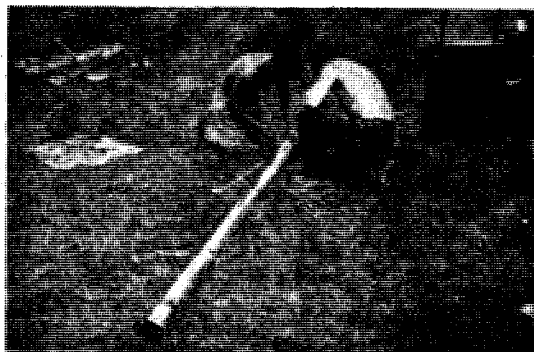


Fig. 2.—The core in the plastic sheath after removal from the barrel

thinner gauge have been obtained, and, if it proves successful, it could be that the 10 thou. thickness will no longer be required.

As a provisional patent application was only granted in August, only one commercial application has been made. This was a series of seven seams taken from the coal measures in the Ashby area, through Mr. K. Spink of the Opencast Executive on behalf of Mr. A. Dawe, of the Coal Survey Laboratory, Nottingham. This proved a complete success, the quality of core recovered from seams which are notoriously difficult being far higher than had been achieved by any other means.

During its development, this technique has passed through a number of changes. Originally plastic tubes were made up and inserted into the barrels, but these raised certain problems, particularly transportation and irregularities of tubing, and today, in many cases, the plastic is merely rolled into a tube, placed in the inner barrel and left to form its own diameter, being wrapped at 6 in. intervals with Cellotape or similar material during extraction.

The advantages of this method are obvious. Apart from preserving cores in their original order and condition in the core box, they can be preserved indefinitely by making good the sheath with adhesive tape after it has been slit open for examination. Packed in this manner cores can be shipped any distance, bringing to a distant office all the advantages that a geologist would find on the actual site.

Included in the company's large fleet of drilling machines and equipment are 16 modern rotary truck mounted machines equipped for air, mud or water flush. A point of interest is that they drilled 664,538 ft. of open hole and took 27,785 ft. of core during the 12 months ending July 31 last.

Two drills were used at a recent demonstration of the above technique.

The Reich Model 600 rotary drill is manufactured by the Reichdrill Manufacturing Co. Ltd., of Wishaw, Lanarkshire. The rig is essentially a blast hole drill using a power arm instead of a derrick. It is mounted on a Scammell "Constructor" 6 x 6 chassis with a Rolls Royce C.6 (132 h.p.) diesel engine driving, through a transfer box, a compressor, a main hydraulic pump, and certain minor hydraulic pumps for subsidiary operations. This drill is rated at 600 ft. with 3½ in. drill pipe, although capable of greater depths under good conditions.

Designed originally as a blast hole drill or as an exploratory drill to work in areas where water was

unobtainable or too expensive, this rig is particularly efficient in this type of work where, for example, the heavy hydraulic jacks fitted at front and rear and the fact that the rig is self-propelled on a six-wheel drive chassis with a powerful winch at the front, make it extremely quick in movement and setting up.

The Boyles B.B.S. 20 A/W rig is basically a standard B.B.S. 20, i.e. a conventional rotary rig rated to 1,500 with "N" equipment, 1,000 with "H" and 1,800 with "A" and "B." "N" equipment is in use. The drill is powered by a Perkins P.6 diesel engine and is mounted on a Douglas 6 x 6 chassis powered with another Perkins P.6 diesel engine.

In order to cope with situations where air flush is not suitable, a Boyles Bros. circulation pump and a 600 gal. water tank are fitted on the chassis between drill and cab. By a system of valves, the driller can select water or air as the case may require. The pump is a single-stage piston capable of 1,200 gal. per hour at up to 300 p.s.i., and is independently driven by a Lister L.D.2 diesel engine.

The rock bits generally used are Hughes roller bearing bits, since although there are some formations in which these are not suitable, they have generally been found the most efficient for the coal measures. In drift or unconsolidated formations, of course, some form of drag bit is used.

Three types of core barrels are in use, for the 4 in. core either a Boyles Bros. Type 550 or the original barrels supplied with the Reich drills, manufactured by Sprague and Henwood. Barrels used with the B.B.S. 20,

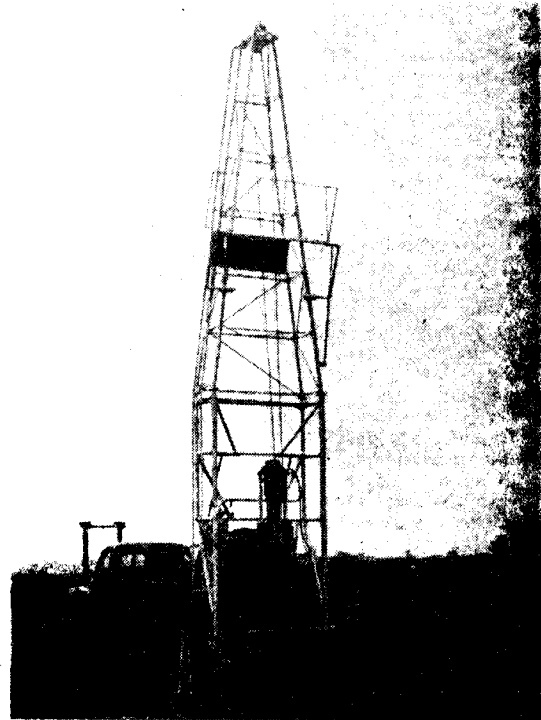


Fig. 3.—The Boyles B.B.S. 20 A/W drilling rig used at recent demonstration

which give a 3 in. core, are also by Boyles Bros. and are specially designed for air flush being known as their type 412.

The design of a suitable diamond bit to work with these barrels took a long time and cost a considerable amount of money, being principally trial and error.

After three years' experience two basic types which appear most suitable have been found, and these are manufactured by Messrs. Van Moppes Ltd. and

Messrs. Triefus Industries Ltd., both of whom have spent a lot of time studying the requirements and trying to meet them. In addition to the diamonds a Hedgehog type of tungsten carbide insert coring bit, originally produced and designed by Messrs. Fife Engineering Ltd., has proved very efficient in the softer stratas. They do not generally give the same quality as a diamond, but they will cut a core where a diamond balls up.

Ventilating Fan Protection

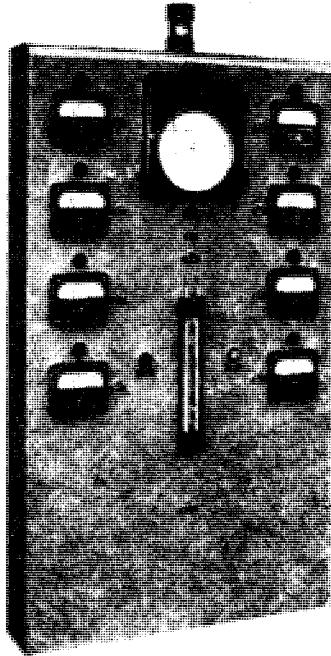
The Accurate Recording Instrument Co., Windsor Avenue, Merton, London, S.W.19, have developed a system of ventilating fan protection applicable to coal mining, and is designed to prevent breakdowns in the event of bearings overheating, loss of air in the pit due to low fan speeds or falls in the workings. In addition a device has been developed which will cause an alarm to sound should a vee rope (in cases where these are used) either start to wear or break.

Oil temperature and pressure protection is supplied where gearboxes are used to transmit the drive from the prime mover. The Pressurestat will cause the alarm circuit to function in the event of low pressure in the gearbox lubrication system. The principle of the temperature measurement of the bearings is their well-known liquid expansion system as applied to the now famous indicating thermostat. A rise in temperature at a bearing measuring point (normally in the oil reservoir) causes a bellows to operate a micro-switch (capable of 10 amp. at 250 volts), which in turn closes a visual lamp and audible alarm circuit, thereby drawing attention to any attendant that the particular bearing has reached a temperature likely to cause a breakdown of that bearing. The audible alarm may be silenced, but a flashing lamp is immediately switched on showing that alarm conditions exist. This lamp and that associated with the bearing will remain alight until action has been taken to restore conditions to normal. The preset point at which the alarms come into circuit is infinitely variable over the whole of the instrument scale range, by means of a special key, and is normally set some 5 deg. F. to 10 deg. F. above the normal working temperature of the bearing. If, however, the temperature of the bearing should continue to rise, a second switch is operated which in turn will cut the mains supply to the fan motor, thus stopping the fan and avoiding further damage.

The instrument is fitted with a third micro-switch which is operated in the event of the instrument becoming unserviceable through any known cause, thereby providing a "fail to safe" system. The whole of the thermometry is of the "fully compensated" type and is not affected by changes of ambient temperature along lengths of capillary and instrument head.

The draught gauge recorder measuring the air pressure in the pit is fitted with high and low contacts which are variable and normally set at some point lower and higher than the normal. Should a variable condition occur, one of these contacts will cause a visual and audible alarm to be made as in the case of the bearing temperature.

The whole of the visual and audible alarms may be transmitted to a small remote supervisory panel up to a



The alarm equipment recording panel

considerable distance, together with precise readings on a 6 in. indicator of the water gauge suction conditions. This means that the more important functions of the system may be located at a remote point and can be under the supervision of persons doing another job. The fan belt alarm operates into the common visual and audible alarm circuit and is designed to bring to the notice of the persons responsible the fact that a belt is about to break or has broken.

The equipment is housed in attractive sheet steel panels for floor mounting, and is self-contained, as illustrated. The attractive feature to mining engineers is that the important measuring instruments are mechanical, and do not depend on mains electrical supply for correct operation, are very sensitive to small changes of temperature and are of very robust construction.

E



Department of Mines and Technical Surveys
Ministère des Mines et des Relevés techniques

MINES BRANCH

File Number
N^o à rappeler

Fuels and Mining Practice Division

562 Booth Street,
Ottawa 1, Ontario,
July 8, 1966.

Mr. C.H. MacDonald,
Project Manager,
Anvil Mining Corporation Limited,
P.O. Box 2470,
103 Polaris Block,
WHITEHORSE, Yukon Territory.

Dear Mr. MacDonald:

The proximate analysis and the free swelling properties of grab samples taken from the twelve gross samples from Tantalus Butte Mine have been completed and are given in attached table. Grab samples were selected to indicate quickly the properties of the Tantalus Butte coal. As may be observed from the coke button the coal as received is non-coking. Cleaning the coal to reduce the ash content may show marginal improvement in the coke button however coal of this rank is not normally considered in the range of coking coals.

As considerable effort was made to obtain these samples we will carry out washability tests and other analysis on the samples to improve our general knowledge of the coal under review.

Yours very truly,

A. Ignatieff, Chief,
Fuels and Mining Practice Div.

JCB:PH
c. c. A. D. Oliver
R. D. Cathro

RECEIVED
JUL 13 1966
WHITEHORSE

Twelve samples coal submitted by Anvil Mining Corporation

Laboratory No.	Identification	Dry			FSI
		Ash	Volatile	Fixed Carbon by Diff.	
2658-66	Box No. 1 - H. W.	16.06	34.21	49.73	1
2659-66	Box No. 2 - H. W.	14.29	34.99	50.72	1
2660-66	Box No. 3 - H. W.	12.85	35.24	51.93	1
2661 - 66	Box No. 4 - H. W.	12.28	35.34	52.38	1
2662-66	Box No. 5 - M. W.	11.41	37.54	51.05	1
2663-66	Box No. 6 - M. W.	15.35	34.80	49.85	1
2664-66	Box No. 7 - M. W.	11.83	35.54	52.63	1
2665-66	Box No. 8 - M. W.	14.92	35.12	49.96	1
2666-66	Box No. 9 - F. W.	14.56	31.56	53.88	1/2
2667-66	Box No. 10-F. W.	18.47	31.72	49.81	1/2
2668-66	Box No. 11-F. W.	20.93	30.14	48.93	1
2669-66	Box No. 12-F. W.	21.70	31.21	47.09	1

ARCHER, CATHRO & ASSOCIATES LTD.

CONSULTING GEOLOGICAL ENGINEERS

P.O. Box 1051
WHITEHORSE

August 30, 1966

Mr. A. Ignatieff, Chief,
Fuels & Mining Practice Division,
Dept. of Mines & Technical Surveys,
562 Booth St.,
Ottawa 1, Ontario.

RECEIVED
SEP 1 1966
WHITEHORSE

Dear Sir:

We are shipping to you today by truck two boxes of coal samples from the Carmacks district. These samples are from a new exposure recently uncovered by bulldozer trenching about one mile due south of the old Tantalus Mine on the south bank of the Yukon River. The trenching was done under our supervision on behalf of Anvil Mining Corp.

The new seams dips 60° east and appears to be about thirty feet wide in the trenches. This width may in effect represent two or three seams separated by narrow (12"-18") bands of rock. The samples are quite fresh and were obtained at a depth of about fifteen feet.

Our prime interest is still in coking coal and you will recall that the only good coke ever reported from the Carmacks area was from a sample taken in 1908 from the Tantalus Mine lower seam and tested at the Otto Hoffman ovens of the Dominion Iron and Steel Co. Ltd., Sydney, Nova Scotia. The total width from the top of the upper seam to the bottom of the lower

. . . . 2.

seam, including four and seven foot rock separations, was 28 feet. It is possible that the newly trenched seams are the Tantalus Mine seams, with less rock separation between the seams, although we were unable to locate coal through the heavy overburden in the intervening mile to definitely correlate them. The new seam occurs in sandstone and is overlain by pebble conglomerate. Isolated outcrops of conglomerate occur 50 feet uphill but the coal was completely obscured by a cover of vegetation, volcanic ash and glacial clay two to three feet thick (see sketch).

We would like to have your comments on this coal as soon as possible. A large sample can be readily obtained from the trenches until about mid- October. However, should you require a fresher sample from greater depth it will be necessary to diamond drill or sink a prospect shaft which will naturally involve a substantial expenditure.

Yours truly,

ARCHER, CATHRO & ASSOCIATES LTD.

bc

R.J. Cathro

cc. C.H. MacDonald ✓

A.D. Oliver

Copy to R.E.T.
File (L.A.) Carmacks Coal.
Sent Oct. 3/66
2000.

Fuels and Mining Practice
Division

562 Booth Street
Ottawa 1, Ontario
September 28, 1966

Mr. R. J. Cathro
Archer, Cathro & Associates Ltd.
P. O. Box 1051
Whitehorse, Yukon

Re: Two Coal Samples One Mile South of Old Tantalus Mine,
Carmacks District

Dear Mr. Cathro:

We are enclosing a copy of the report of analysis of samples #1 and #2 from the bulldozer trenching for the Anvil Mining Corporation. This refers to the coal samples described in your letter of August 30, 1966.

The analytical reports show that neither of these samples of coal will agglomerate to form coke. A qualitative petrographic examination was made of both samples to determine if oxidation by surface water might be the cause of the absence of coking qualities. If so, one would be encouraged to drill deeper to obtain coking coal. Unfortunately, the petrographic indications are not encouraging as both samples of coal contain a large proportion of infusible material that is associated with the character of the coal substance and cannot be ascribed to oxidation though there is also an indication of a small amount of oxidation.

In the light of these results, we do not think that your clients should be put to further expense in obtaining coal from the same trenches for a technical scale coke oven test. While the analytical results do not justify the hope that at depth improved coking properties are to be expected, your clients may wish to satisfy themselves on the coking properties of the seam at another and deeper location on strike by drilling a hole before considering any other form of exploration.

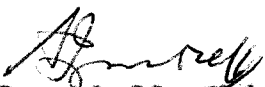
-----Continued

September 28, 1966

2 -- Mr. R. J. Cathro

We will be pleased to co-operate with our analytical contribution to the fullest possible extent.

Yours very truly,


A. Ignatieff, Chief
Fuels and Mining Practice
Division

AI:sr

cc Mr. C. H. MacDonald ✓
Anvil Mining Corp.
Whitehorse, Yukon

Mr. A. D. Oliver, Resident Mining Inspector
Dept. of Northern Affairs & National Resources
Whitehorse, Yukon Territory



Quote File 3039-66

FUEL RESEARCH LABORATORIES

MINES BRANCH
Fuels and Mining
Practice Division.

CANADA
DEPARTMENT
OF
MINES AND TECHNICAL SURVEYS

OTTAWA, September 22, 1966

REPORT OF ANALYSIS

Sample of coal submitted by Archer Cathro and Associates as per advice addressed to Chief, Fuels and Mining Practice Division. Sample designated as Anvil Mining Co., delivered to Bulldozer Trenching.

Date Received.	September 19, 1966			
Sample Mark	1			
Moisture Condition		As Rec'd	Dry	As Rec'd Dry
Proximate Analysis				
Moisture.	%	13.4	0.0	
Ash	%	12.8	14.8	
Volatile Matter	%	22.5	26.0	
Fixed Carbon (By Difference).	%	51.3	59.2	
Ultimate Analysis				
Carbon	%			
Hydrogen	%			
Sulphur	%			
Nitrogen	%			
Ash	%			
Oxygen (By Difference).	%			
Calorific Value	Btu/lb. Gross			
Fusibility of Ash				
Initial Deformation Temperature. . . °F				
Softening Temperature, Spherical . °F				
Softening Temperature, Hemispherical. °F				
Fluid Temperature. °F				
Grindability Index, Hardgrove				
Screen Analysis				
Screen Size				
Swelling Index: 0 Non Agglomerate	%			
	%			
	%			
	%			
	%			

Remarks:

Reported by: W. J. Montgomery, Head,
Solid Fuels Laboratory.

A. Ignatieff
A. Ignatieff, Chief,
Fuels and Mining Practice Division

Distribution:



Quote File 3040-66

FUEL RESEARCH LABORATORIES

OTTAWA, September 22, 1966

MINES BRANCH
Fuels and Mining
Practice Division.

CANADA
DEPARTMENT
OF

MINES AND TECHNICAL SURVEYS

REPORT OF ANALYSIS

Sample of coal submitted by Archer Cathro and Associates as per advice addressed to Chief, Fuels and Mining Practice Division. Sample designated as Anvil Mining Co., delivered to Bulldozer Trenching.

Date Received.	September 19, 1966			
Sample Mark	2			
Moisture Condition	As Rec'd	Dry	As Rec'd	Dry
Proximate Analysis				
Moisture. %	13.7	0.0		
Ash %	24.1	28.0		
Volatile Matter %	21.5	24.9		
Fixed Carbon (By Difference). . . . %	40.7	47.1		
Ultimate Analysis				
Carbon %				
Hydrogen %				
Sulphur %				
Nitrogen %				
Ash %				
Oxygen (By Difference). %				
Calorific Value Btu/lb. Gross				
Fusibility of Ash				
Initial Deformation Temperature. . °F				
Softening Temperature, Spherical . °F				
Softening Temperature, Hemispherical. °F				
Fluid Temperature °F				
Grindability Index, Hardgrove				
Screen Analysis				
Screen Size				
Swelling Index: 0 Non Agglomerate	%			
	%			
	%			
	%			
	%			
	%			

Remarks:

Reported by: W J. Montgomery, Head,
Solid Fuels Laboratory.

A. Ignatieff, Chief,
Fuels and Mining Practice Division

Distribution:

ARCHER, CATHRO & ASSOCIATES LTD.

CONSULTING GEOLOGICAL ENGINEERS

P.O. Box 1051
WHITEHORSE

October 3, 1966

*Carmath
Coal*

Mr. A. Ignatieff, Chief,
Fuels & Mining Practice Division,
Dept. of Mines and Technical Surveys,
562 Booth St.,
Ottawa 1, Ontario.

Dear Sir:

Thank you for your report of September 28 on analysis of coal samples from the vicinity of the old Tantalus Mine. The results are disappointing from a coke standpoint although they do substantially increase the reserves of thermal coal in this area. Mr. Oliver has suggested that you might be able to determine by spore identification whether this seam is the same as that presently worked at the Tantalus Butte Mine. Your comments would be appreciated. If you do not still have some of the Tantalus Butte Mine sample on hand I could arrange to send you some more. Without diamond drilling we cannot even be sure that the new seam is the same one mined at the Tantalus Mine.

We are sending you via air today about fifty pounds of coal from a seam near Ross River. This is a new discovery uncovered during road construction and lies in a conglomerate-shale-sandstone sequence dated by the G.S.C. as Paleocene. It is referred to as the Whisker Lake seam. Thus far it is partially exposed in only one shallow pit and does not outcrop. It is of interest as a possible coke source and, because of its nearness to the Anvil-Vangorda mining district, as a source of thermal coal as well. The sample is quite weathered and bulldozing will be required to obtain better samples.

The owner claims that the following analysis was obtained, although no details are available on the analyst:

Moisture	4.04
Ash	3.02
Volatiles	21.43
Fixed Carbon	69.51

We have a few weeks yet, before the ground freezes, in which to bulldoze and this decision will depend in part on your proximate analysis and how quickly it can be done. Your comments on this coal will be greatly appreciated.

Yours truly,
ARCHER, CATHRO & ASSOCIATES LTD.



R.J. Cathro

cc. C. MacDonald ✓
A. Oliver

RJC:ps

also asked him for a calorific value for berrinocks and how Berrin coals
RJC

RECEIVED
OCT 1952
WHITENORSE

Copy to
R. E. T.
L.A.

Fuels and Mining Practice
Division

562 Booth Street
Ottawa 1, Ontario
October 18, 1966

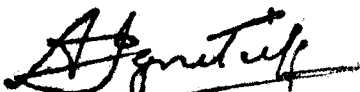
Mr. R. J. Cathro
Archer, Cathro & Associates Ltd.
P. O. Box 1051
Whitehorse, Yukon Territories

Dear Mr. Cathro:

With reference to your letter of October 3rd, we enclose a report on the Ross River sample of coal which shows that this is a reasonable steam coal, but not a coking coal.

An average calorific value of the Carmacks coal is 11,440 Btu/lb. Gross (as received) and 11,920 Btu/lb. Gross (dry).

Yours very truly,


A. Ignatieff, Chief
Fuels and Mining Practice
Division

AI:sr

cc Mr. C. H. MacDonald, Anvil Mining Corp. Ltd.
Mr. A. D. Oliver, Dept. of Northern Affairs &
National Resources

RECEIVED
OCT 21 1966
WHITEHORSE



Quote File .3136-66.....

MINES BRANCH
Fuels and Mining
Practice Division.

FUEL RESEARCH LABORATORIES

CANADA
DEPARTMENT
OF

OTTAWA, October 17, 1966.

MINES AND TECHNICAL SURVEYS

Coal

REPORT OF ANALYSIS

Sample of coal submitted by Archer Cathro and Associates, Whitehorse, Y. T. as per advice addressed to Chief, Fuels and Mining Practice Division dated October 3, 1966. Sample designated as seam near Ross River.

Date Received.	October 11, 1966			
Sample Mark	Ross River - Tantalus Butte (Carmacks)			
Moisture Condition	As Rec'd	Dry	As Rec'd	Dry
Proximate Analysis				
Moisture. %	5.2	0.0	4.0	0.0
Ash %	3.6	3.8	13.5	14.1
Volatile Matter %	20.8	22.0	31.7	33.0
Fixed Carbon (By Difference). . . . %	70.4	74.2	50.8	52.9
Ultimate Analysis				
Carbon %	77.2	81.4	68.2	71.0
Hydrogen %	3.7	3.9	4.4	4.6
Sulphur %	0.2	0.2	0.9	0.9
Nitrogen %	1.0	1.1	0.4	0.4
Ash %	3.6	3.8	13.5	14.1
Oxygen (By Difference). %	9.1	9.6	8.6	9.0
Calorific Value Btu/lb. Gross	12,920	13,630	11,440	11,920
Fusibility of Ash				
Initial Deformation Temperature. . °F				
Softening Temperature, Spherical . °F				
Softening Temperature, Hemispherical. °F				
Fluid Temperature. °F				
Grindability Index, Hardgrove				
Screen Analysis				
Screen Size	%	%	%	%
Swelling Index 0	%	%	%	%

Remarks:

Reported by: W.J. Montgomery, Head

A. Ignatieff
A. Ignatieff, Chief,
Fuels and Mining Practice Division

Distribution: Solid Fuels Laboratory.
Archer, Cathro and Associates Ltd.,
P.O. Box 1051,
Whitehorse, Y. T.



Quote File 3136-66

MINES BRANCH
Fuels and Mining
Practice Division.

FUEL RESEARCH LABORATORIES

CANADA
DEPARTMENT
OF
MINES AND TECHNICAL SURVEYS

OTTAWA, October 17, 1966.

REPORT OF ANALYSIS

Sample of coal submitted by Archer Cathro and Associates, Whitehorse, Y. T. as per advice addressed to Chief, Fuels and Mining Practice Division dated October 3, 1966. Sample designated as seam near Ross River.

Date Received.	October 11, 1966			
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Moisture Condition	As Rec'd	Dry	As Rec'd	Dry
Proximate Analysis				
Moisture. %	5.2	0.0	4.0	0.0
Ash %	3.6	3.8	13.5	14.1
Volatile Matter %	20.8	22.0	31.7	33.0
Fixed Carbon (By Difference). . . . %	70.4	74.2	50.8	52.9
Ultimate Analysis				
Carbon %	77.2	81.4	68.2	71.0
Hydrogen %	3.7	3.9	4.4	4.6
Sulphur %	0.2	0.2	0.9	0.9
Nitrogen %	1.0	1.1	0.4	0.4
Ash %	3.6	3.8	13.5	14.1
Oxygen (By Difference). %	9.1	9.6	8.6	9.0
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Fusibility of Ash				
Initial Deformation Temperature. . °F				
Softening Temperature, Spherical. °F				
Softening Temperature, Hemispherical. °F				
Fluid Temperature. °F				
Grindability Index, Hardgrove				
Screen Analysis				
Screen Size	%	%	%	%
Swelling Index 0	%	%	%	%

Remarks:

Reported by: W. J. Montgomery, Head

[Signature]
A. Ignatien, Chief,
Fuels and Mining Practice Division

Distribution:
Solid Fuels Laboratory
Archer, Cathro and Associates
P.O. Box 100
Whitehorse, Y.T.

RECEIVED
OCT 21 1966
WHITEHORSE

Carbonyl
HAZEN RESEARCH, INC.



4601 INDIANA STREET
GOLDEN, COLORADO • 80401
TELEPHONE 279-4549

October 20, 1967

Mr. Eugene S. Allen
Manager of Technical Services
Anvil Mining Corporation, Ltd.
523 West 6th Street
Los Angeles, California 90014

Re: HRI Project No. 160

Dear Mr. Allen;

→

TO CHM		REPLY
RETURN TO		COMMENT
OCT 23 1967		
1	<i>Carbonyl</i>	6
2		7
3		8
4		

The coal sample from the Carmacks Coal Mine, Yukon Territory has been ashed and analysed. The sample which we received contains 16.2% ash, by weight. Following are the analytical assays of the ash.

Pb	350 ppm	Ge	ND (<1 ppm)
Zn	800 ppm	In	ND (1 ppm)
Cu	400 ppm	Mn	0.1%
Ag	ND (<1 ppm)	Hg	ND (<1 ppm)
Au	ND (<5 ppm)	Si	19.40%
Fe	4.20%	Sn	600 ppm
As	ND (<1 ppm)	Mg	3.68%
Sb	ND (<10 ppm)	Ca	4.78%
Bi	ND (<5 ppm)	Al	9.16%
Cd	ND (<1 ppm)		

ND = Not Detected

Very truly yours,

Delmer L. Brown
Delmer L. Brown
Geological Engineer

DLB:br

Carmacks Coal
HAZEN RESEARCH, INC.



4601 INDIANA STREET
GOLDEN, COLORADO • 80401
TELEPHONE 279-4549

November 2, 1967

Mr. Eugene S. Allen
Manager of Technical Services
Anvil Mining Corporation, Ltd.
523 West Sixth Street
Los Angeles, California 90014

Re: HRI Project No. 160

TO	<i>[Signature]</i>	REPLY	
RETURN TO	<i>[Signature]</i>	COMMENT	
NOV 3 - 1967			
1	<i>Coaxc</i>	5	<i>W.A.H. Xc</i>
2	<i>RC+ Xc</i>	6	
3	<i>CHM Xc</i>	7	
4	<i>SFD Xc</i>	8	

Dear Mr. Allen:

I have today received from our analytical department additional assays of the coal sample from the Carmacks Coal Mine, Yukon Territory.

Cl	0.01%
S	0.256%
F	24 ppm
Acid Insoluble	58.28%

Very truly yours,

Delmer L. Brown
Geological Engineer

DLB:jb

RECEIVED
NOV-21-1967
WHITEHORSE

March 13, 1978

Mr. A. Ignatieff *no longer in this position*
Chief, Fuels & Mining Practice Division
Department of Mines, Energy & Resources
562 Booth Street
Ottawa 1, Ontario

Dear Sir:

Two small coal samples are being sent to you by parcel post. We would like B.T.U. value, ash, etc. tests on these samples.

These samples A.T. #1 and T.R. #5 are from approximately 1 mile and 1½ miles respectively south of the Tantalus Mine at Carmacks, Yukon. It is the area in which a large sample for coking tests was made by Archer, Cathro & Associates about two years ago.

Sample A.T. #1 was collected from 10 feet of percussion drill cuttings from 135-145' from the intersection 129-174 with siltstone parting 144-145'.

Sample T.R. #5 is from a surface trench along the seam. The seam dips to the N.E. at 15 degrees, 19 feet true thickness for the trenches and 5 feet for a strike length of about 3000 feet.

Yours truly,

M.O.H.
✓ M.O.H.
Chief Engineer
& Chief of Exploration

MOH/ew



Department of Energy, Mines and Resources
Ministère de l'Énergie, des Mines et des Ressources

Mines Branch
Direction des mines

File Number
No à rappeler

Fuels Research Centre

562 Booth Street
Ottawa, Ontario
May 10, 1968

Mr. M. O. Hampton
Chief Engineer and
Chief of Exploration
Anvil Mining Corporation Limited
P.O.Box 2470 - 103 Polaris Block
Whitehorse, Yukon Territory

Dear Mr. Hampton:

We have completed the analysis on the two samples that were referred to in your letter of March 13.

In addition to the analysis requested, we made a petrographic examination of these two samples to gain a clearer insight into the reasons for their different agglomeration behaviour.

The microscopic examination reveals the high ash content. In addition, it shows that both samples contain a very large proportion of coal matter constituents, known as, fusinite, semifusinite, and micrinite. This information is summarized in the brief table below:

	<u>T.R.No.5</u>	<u>A.T.No.1</u>
Reactives (Vitrinite - 1/3 Semifusinite)	45	40
Inerts (Fusinite, Semi- fusinite & Micrinite)	55	60.

The sample collected from the surface trench of T.R. No. 5 shows a very high proportion of semifusinite. This constituent will not fuse on heating and, in our view, explains why this coal is non-agglomerating.

Mr. M. O. Hampton

-2-

May 10, 1968

The photomicrograph on sample A.T. No. 1 was carefully picked to show a band of vitrinite. This appears in the lower portion of the picture as a smooth structure almost devoid of holes. The presence of this vitrinite, no doubt, explains the very slight agglomerating characteristics shown by this coal.

We are not certain of the application you had in mind for these coals, but inferred from your letter of March 13 that you are interested in the possibilities of this coal from the point of view of coke-making. This follows from the interest of Archer Cathro and Associates in having coking tests done.

The samples A.T. No. 1 and T.R. No. 5 suggest to us that sample A.T. No. 1 is definitely superior to sample T.R. No. 5 from the point of view of agglomeration, but that neither coal sample shows much promise of making first class metallurgical coke. The rank is too low, the mineral matter is very high, and the agglomerating characteristics are marginal. On the other hand, from the point of view of base metal smelting, there may be some possibility of cleaning this coal and blending it with a more fluid coal to make something acceptable to the trade.

We would be prepared to evaluate further samples, but it would help us if we knew the proposed outlet for the coal.

Yours sincerely,



D. S. Montgomery, Head
Fuels Research Centre

DSM:sr
Encl.



CANADA

file 2513-68

Mines Branch
Fuels Research Centre

Department
of
Energy, Mines and Resources

Solid Fuels Laboratory

Ottawa May 6, 1968

REPORT OF ANALYSIS

Sample of coal submitted by Anvil Mining Corporation Ltd. as per advice dated March 13, 1968

Date Received.	April 2, 1968			
Sample Mark.	AT - 1			
Moisture Condition	As Rec'd	Dry	As Rec'd	Dry
Proximate Analysis				
Moisture. %	0.5	0.0		
Ash. %	33.0	33.1		
Volatile Matter. %	20.9	21.0		
Fixed Carbon (By Difference) . . %	45.6	45.9		
Ultimate Analysis				
Carbon. %				
Hydrogen. %				
Sulphur %	0.4	0.4		
Nitrogen. %				
Ash. %				
Oxygen (By Difference). %				
Calorific Value. Btu/lb Gross	9360	9400		
Fusibility of Ash				
Initial Deformation Temperature. °F				
Softening Temperature. °F				
Hemispherical Temperature. . . . °F				
Fluid Temperature. °F				
Grindability Index, Hardgrove. . .				
Screen Analysis				
Screen Size				
_____ %				
_____ %				
_____ %				
_____ %				
_____ %				
_____ %				

Remarks: Agglomerate — added note from
mail correspondence
M.O.M.

Reported by: W.J. Montgomery, Head,
Solid Fuels Laboratory

D.S. Montgomery
Dr. D.S. Montgomery,
Head,
Fuels Research Centre.

Distribution: Anvil Mining Corporation Ltd.
P.O. Box 2470
103 Polaris Block
Whitehorse, Yukon Territory
Canada (2)



CANADA

File 2512-68

Mines Branch
Fuels Research Centre

Department
of
Energy, Mines and Resources

Solid Fuels Laboratory

Ottawa..... Mar 6, 1968

REPORT OF ANALYSIS

Sample of coal submitted by Anvil Mining Corporation Ltd. as per advice dated Mar. 1968

Date Received. April 2, 1968

Sample Mark. TR No. 5

Moisture Condition	As Rec'd	Dry	As Rec'd	Dry
Proximate Analysis				
Moisture. %	7.9	0.0		
Ash. %	32.9	35.7		
Volatile Matter. %	23.7	25.8		
Fixed Carbon (By Difference) . . %	35.5	38.5		
Ultimate Analysis				
Carbon. %				
Hydrogen. %				
Sulphur %	0.4	0.4		
Nitrogen. %				
Ash. %				
Oxygen (By Difference). %				
Calorific Value. Btu/lb Gross	6730	7310		

Usability of Ash
 Initial Deformation Temperature. °F _____
 Softening Temperature. °F _____
 Hemispherical Temperature. . . . °F _____
 Fluid Temperature. °F _____

Grindability Index, Hardgrove. . . _____

Screen Analysis
 Screen Size

_____	%
_____	%
_____	%
_____	%
_____	%
_____	%

Remarks: Agglomerate — added notes from copies accompanying May 10 letter. — M.E.T.

Reported by: W.J. Montgomery, Head,
Solid Fuels Laboratory

Dr. D.S. Montgomery,
Head,
Fuels Research Centre.

Distribution: Anvil Mining Corporation Ltd.
P.O. Box 2470
103 Polaris Block
Whitehorse, Yukon Territory
Canada (2)



Department of Energy, Mines and Resources
Ministère de l'Énergie, des Mines et des Ressources

Mines Branch
Direction des mines

File Number
N° à rappeler

Fuels Research Centre

562 Booth Street
Ottawa, Ontario
May 13, 1968

Mr. M. O. Hampton
Chief Engineer and
Chief of Exploration
Anvil Mining Corporation Limited
P.O.Box 2470 - 103 Polaris Block
Whitehorse, Yukon Territory

Dear Mr. Hampton:

In view of the rather unusual nature of the coal samples which you sent to us, designated by A.T. No. 1 and T.R. No. 5, would it be possible for you to send us, at your convenience, a few large lumps (say, 2 inches in diameter) of this coal for further petrographic examination.

Yours sincerely,

D. S. Montgomery, Head
Fuels Research Centre

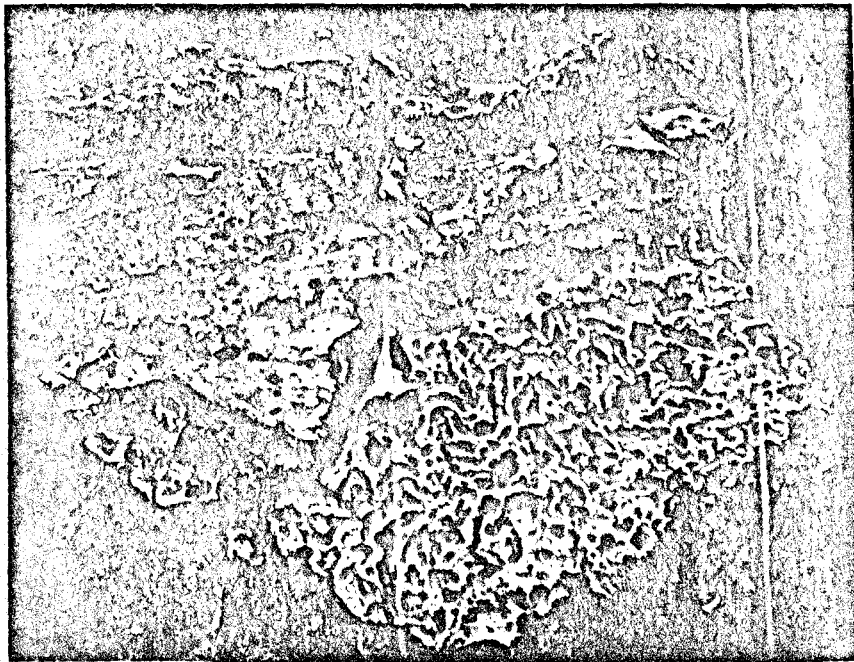
DSM:sr

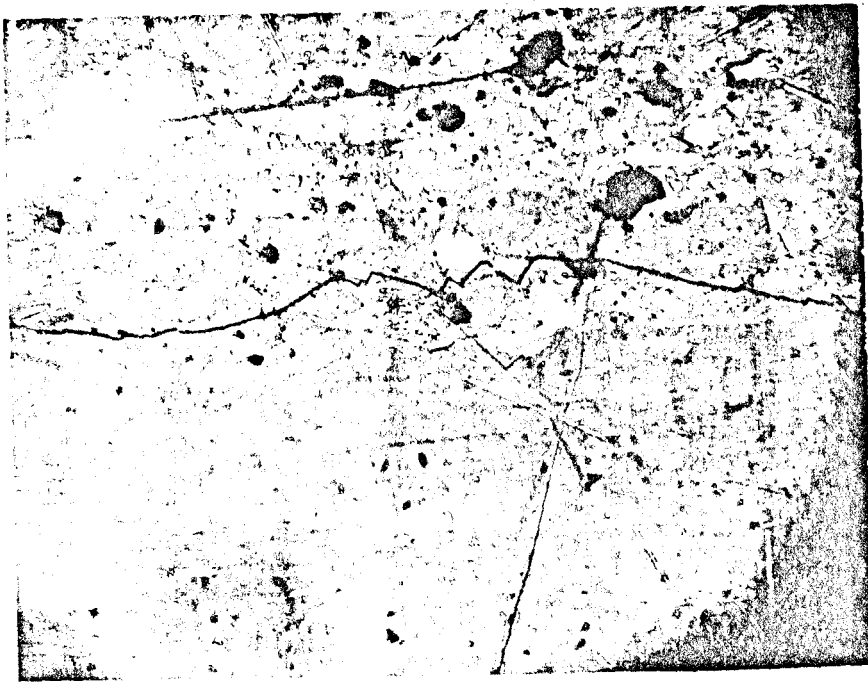
*cc. to Lal & samples to be picked up after limestone
mapping job.*

W

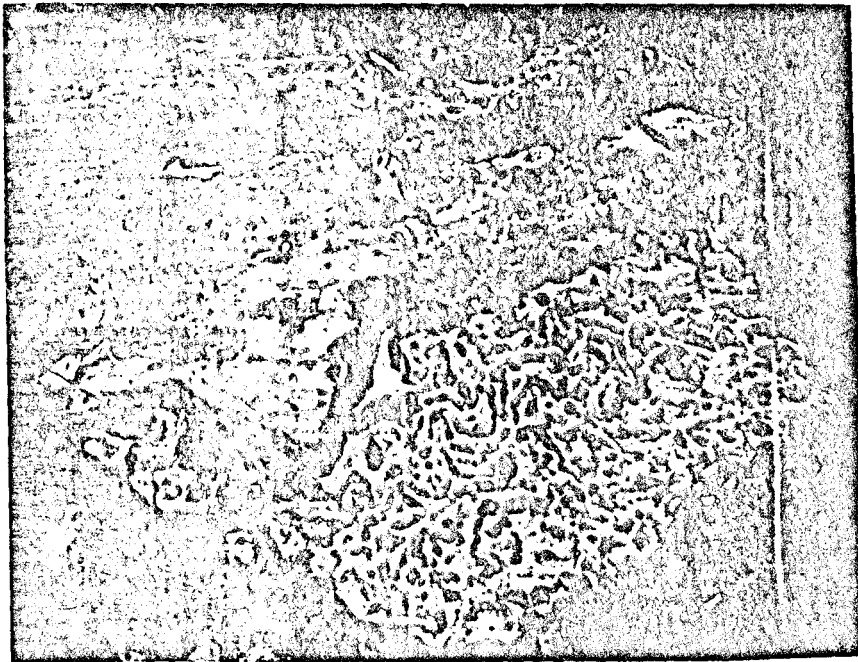


Micrograph



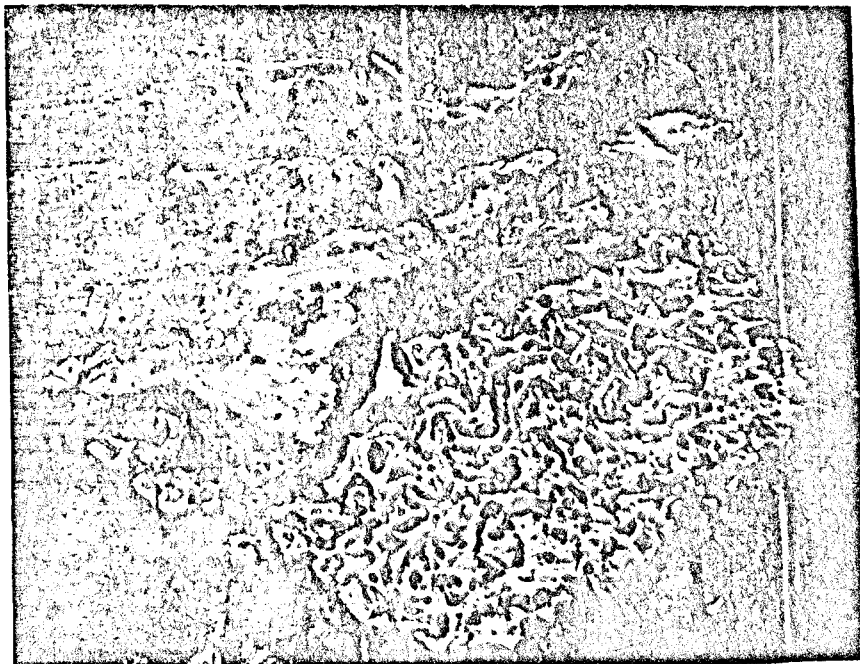


Vitrinite





Vitrinite



MEMORANDUM

To: C.H. Macdonald
From: M.O. Hampton
Date: May 16, 1968
Subject: CARMACKS COAL ANALYSIS

Attached are copies of the analysis of coal samples from Anvil's Carmacks seam and related correspondence. The ash is higher and BTU value lower than previous samples from this seam yielded. A.T. #1 sample was drill cuttings from which much carbon probably was blown away. T.R. #5 was a surface sample ripped out with the Cat.

I am not sure either sample should be trusted but indicates more sampling is in order before any major development.

for
✓ M.O. Hampton
Chief Engineer

MOH/ew

Attach.

cc: J.F. Olk

May 21, 1968

Mr. D.S. Montgomery, Head
Fuel Research Centre
Dept. of Energy, Mines & Resources
562 Booth Street
Ottawa, Ontario

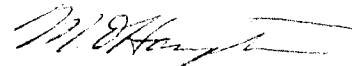
Dear Mr. Montgomery:

Re: Yours of May 10 and 13.

We will have a geologist working in the Carnackst area this week and will have him collect the coal samples for you while there.

As to the application we have in mind for this coal, our immediate interest is for heating purposes. However, we are interested in the possibilities of using a local coal for base metal smelting in the future.

Yours truly,



M.O. Hampton
Chief Engineer

MOH/ew

Meeting Room
Copy M.O.H.

June 7, 1968

RECEIVED
JUN 11 1968
ATTENTION OF

Anvil Mining Corporation Limited
523 West Sixth Street
Los Angeles, California 90014

ATTENTION of Mr. R. F. Thurmond

SUBJECT: The Anvil Project
Job No. 3746-06
Carmacks Coal

Gentlemen:

We have copy of memorandum from M.O. Hampton to C.H. Macdonald dated May 31, 1968 and note the comments on friability.

Our present flow sheet shows R.O.M. Coal at the mine hand sledged thru 5"-6" grizzly. Transportation to the plant site is at the minus 5"-6" size or in essence this top size will be governed by the coarsest material, the concentrate trucks can handle without damage to the containers.

At the plant the containers will be either dumped directly into a hopper, crushed to all minus 1 1/4" and transferred to bins or the incoming coal will be stockpiled and transferred to crushing hopper as needed.

By transporting as coarse as possible and use of reasonable care in stockpiling and rehandlings ahead of the crusher we would expect the minimum generation of coal fines.

As you know our stokers are sized to deliver the required Btu with a coal feed all minus 1 1/4" and up to 50% minus 1/4" and with regard to the low fusion properties of the coal.

We have investigated use of powdered coal and find unanimous opinion that our relatively low burning rates for the various pieces of equipment involved is so small that continuous combustion could not be supported by the fuel alone require extraneous oil fuel at high cost to develop continuity. This therefore is the basic reason for not using powdered coal. We realize the use of powdered coal would solve any abnormal fines problem which might occur but is apparently not practical for Anvil.

Anvil Mining Corporation Limited

June 7, 1968

As you know our original premise was to burn only the plus 1/4" fract. on of the coal after screening and wasting the minus 1/4" fraction.

This procedure, of course, was very wasteful of coal, would require screening of all coal and could create a fines disposal problem. The Riley stoker people have experience with Carmacks Coal and apparently up to 50% fines can still be burned but at slower rates and lesser btu output.

Very truly yours,

ANVIL MINING CORPORATION LIMITED

W.A.H.

Walter A. Hamilton
Owners Representative for
Anvil Mining

WAH:rw

cc: E. S. Allen
C. Macdonald ✓
D. Van De Voort

CONFIDENTIAL

CANADA

DEPARTMENT OF ENERGY, MINES AND RESOURCES

MINES BRANCH

OTTAWA

RESULTS ANALYSIS COAL SAMPLES 71-2

Fuels Research Centre

Divisional Report FRC 72/48-FSC

EVALUATION OF COKING COALS FROM
CARMACKS AREA, YUKON TERRITORY

by

B. N. Nandi and D. S. Montgomery

May 1972

EVALUATION OF COKING COALS FROM
CARMACKS AREA, YUKON TERRITORY

by

B. N. Nandi* and D. S. Montgomery**

*Prob. has been used
9 rest. Tentative.*

INTRODUCTION

Four coal samples from the diamond drill Hole #2 in the Carmacks Area, Yukon Territory were sent by Mr. J. E. Hlavay, President, Teslin Exploration, to the Fuels Research Centre for chemical and petrographical evaluation. The property from which the samples were taken is located in Drill Hole #2 in the Carmacks (near Anvil Mines) area as shown on the map (Figure 1).

SAMPLES STUDIED

- Sample 1 - 180' - 190' - Powdered coal about minus 48 mesh partial size.
- Sample 2 - 192' - Lump coal of various sizes ranging from 1/4" to 3".
- Sample 3 - 195.6' - Lump coal of various sizes ranging from 1/4" to 3".
- Sample 4 - 211.6' - Core sample of 2" diameter and 4" long.

The four samples weighing about 100 to 250 gms each, were received in plastic bags. Parts of the samples were crushed in accordance with the ASTM Specification for Proximate and Ultimate Analyses, Free Swelling Index, Dilatation Test and Microscopic Examination. These samples are rich in mineral carbonates and part of all 4 samples were leached with 1:1 hydrochloric acid: water for proximate and ultimate analyses and dilatation tests.

EVALUATION PROCEDURE AND RESULTS

- (a) Proximate Analysis (Moisture, Ash, Volatile Matter and Fixed Carbon)
- (b) Calorific Values

Standard ASTM procedures were followed for these determinations and the results are given in Table 1.

* Research Scientist, Fuels Research Centre, Mines Branch

** Head, Fuels Research Centre, Mines Branch

(c) Free Swelling Index

The ASTM Standard Method of Test for Free Swelling Index of coal, ASTM Designation D720-67 procedures was followed and the results are presented in Table 1.

(d) Ultimate Analysis (Carbon, Hydrogen, Nitrogen and Oxygen)

This analysis was performed in Perkin Elmer Model 240 Micro-elemental Analyser and the results are given in Table 1.

(e) Ruhr Dilatometer Test

Reflectance measurements do not, except in severe cases, indicate the extent to which the coal has been oxidized. However, the determination of the dilation properties using the Ruhr Dilatometer together with the microscopic examination of the residue from the dilatometer test gives a better understanding of the nature of the coal and some indication of the state of oxidation of coal. The test measures quantitatively the contraction and dilation of coal when heated at a constant rate of temperature increase of 3°C per minute. This test was conducted according to the German Specification DIN 51739. Coals which show no dilation and very low contraction, although they may agglomerate, are not considered to have the required qualities that will yield a commercial grade of metallurgical coke. The results of this test are given in Table 1.

(f) Microscopic Examination - Maceral Analysis

The samples were polished in accordance with the procedure described in ASTM Designation D-2797, "Method of Preparing Coal Samples for Microscopic Analysis by Reflected Light".

The maceral analyses were conducted according to ASTM Designation D-2799, "Method for Microscopic Determination of Volume Percent of Physical Components of Coals". The macerals were counted at a magnification of 600. The results are given in Table 1.

(g) Reflectance Measurement of Vitrinoid

The reflectance measurements were performed on the polished samples (prepared for microscopic examination described above) according to ASTM

Designation D-2798, Tentative Method for "Determining Microscopically the Reflectance of the Organic Components in a Polished Specimen of Coal". The results are given in Table 1.

DISCUSSION

The Free Swelling Index values of these coals range from 5-1/2 to 9, which were very unusual for high-ash content coal. In order to ascertain whether these high F.S.I. values were due to the evolution of carbon dioxide, Samples 2 and 4 were leached with hydrochloric acid (1:1). The evolution of a tremendous amount of gas, mostly carbon dioxide, indicates that this coal was rich in carbonate minerals. The F.S.I. of the leached coal decreases considerably. Most of the analyses were performed on the leached coal to obtain a better evaluation of the coal substance freed from the hydrochloric acid soluble minerals.

The volatile matter of Samples 1 and 2 (supposed to represent the upper part of seam 180' to 192') was approximately 20% with high-ash content of approximately 36%; whereas the lower part of seam, Samples 3 and 4 (depth 195.6' to 211.6'), the volatile matter was higher, of the order of 27% with a low-ash content of 1.5 to 11.6%.

Petrographic analysis shows all samples consist of about 95 to 98% vitrinite which is very remarkable for coals of any rank. Many difficulties were encountered in classifying this organic matter (vitrinite). The problem was to determine whether the material was impsonite or coal. Microscopically, impsonite has the same structure as coal but it has a hydrogen content of (4.8 - 5.5%) and an oxygen content (1.9 to 5%). The hydrogen content of these coal samples varies from 4.5 to 5.5% and oxygen content 5 to 7%. From the structure of the semi-coke and the results of the ultimate analysis, it is concluded that these samples are not impsonite but coal.

Dilatometric results show that all original coals have high dilatation and contraction. The dilatation of leached Samples 2 and 4 decreases to nil and 24% from 166 to 245% respectively. This decrease in dilatation is probably caused by the removal of carbonate material from the original coal sample. Contraction and plasticity index was also slightly affected.

CONCLUSION

Coal Samples 1 and 2 (upper seam) have a higher ash content than Samples 3 and 4 (lower seam). In spite of a high-ash content the coals have good plasticity and dilatation. The High Free Swelling Index also indicates that these coals are fluid though carbonates are partly responsible for the high swelling index. The rank of the coal is in the range of medium volatile as determined by Reflectance Measurement and Proximate Analysis.

Petrographic Analysis shows these coals are mainly composed of vitrinite which acts as a reactive component in coke making and about 1 to 2% other macerals which are termed as inerts (fusinite, semi-fusinite and micrinite). We would like to point out that it is very unusual to find a coal seam such as this which consists of almost pure vitrinite. The geologists familiar with this area in the Geological Survey of Canada consider that such an occurrence is so unlikely that they question whether the sample submitted represents the entire seam.

The usual specification for coking coal is that the mineral matter be less than 10%. It is therefore clear from the proximate analysis of the acid leached samples that extensive washing is necessary to reduce the mineral matter content to acceptable levels.

Samples 1, 2, 3 and 4 were leached with hydrochloric acid to remove the carbonates so that the volatile matter indicated could only be derived from the coal substance. It was essential to do this in order to classify the coal and to differentiate it from the vein hydrocarbon impsonite.

The dilatation of the non-acid washed Sample 2, was 166 while the acid washed material was nil. It was concluded that the dilatation of this coal was considerably influenced by the carbon dioxide released from the mineral matter. The same comment applies to the acid washed and non-acid washed Sample 4. The contraction of the coal samples submitted indicates that this coal if it can be successfully cleaned to remove the mineral matter would make a very good blending coal for combination with other low-volatile coals of low fluidity from western Canada. With these limitations we consider that this coal could find a market in the Japanese coking coal trade.

Table 1

Proximate Analysis*

	Sample 1 180'-190'	Sample 2 192'	Sample 3 195.6'	Sample 4 211.6'
Moisture	0.48	0.51	0.29	0.54
Ash	37.06	35.24	1.51	11.64
Volatile Matter	19.37	20.60	28.71	26.49
Fixed Carbon	43.09	43.65	69.78	61.67
F.S.I. non-acid leached	5-1/2	9	6-1/2	9
F.S.I. acid leached		7-1/2*		5-1/2*

*Ultimate Analysis (on ash-free basis)

Carbon %	83.8	81.0	77.0	82.42
Hydrogen %	5.3	4.7	4.5	4.9
Nitrogen %	1.1	0.99	0.78	1.0
Oxygen %	7.07	7.44	5.15	5.39
H/C	0.76	0.69	0.70	0.71

Dilatation Tests

Softening Point °C θ_S	396	396 400*	387	384 405*
Contraction % C	22	19 21	28	26 25
Max. Temp. of Contraction °C θ_C	463	450 489	447	440 470
Dilatation %	22	166 Nil	168	245 24
Max. Temp. of Dilatation	498	501 -	507	507 507
Plasticity Index $\frac{C}{\theta_C - \theta_S}$	0.32	0.35 0.24	0.46	0.46 0.40

Reflectance Measurement

Max. Reflectance in Oil R_o	0.96	1.1	1.06	0.98
-------------------------------	------	-----	------	------

Petrographic Analysis

Vitrinite (Reactive)	> 98 %	> 98 %	> 98 %	> 98 %
----------------------	--------	--------	--------	--------

*Analysis and tests done on 1:1 hydrochloric acid leached sample.