K - SAGE CREEK 74(1,3&6)B

(COPY) The maps are located in SC 74(2)B & SC 74(5)B

N.T.S.: 82-G-2

SAGE CREEK COAL
FLATHEAD VALLEY, B.C.

REPORT ON EXPLORATION AND GEOLOGY
JUNE TO SEPTEMBER, 1974

H.W. Marsh
O. Cunningham

May, 1975

ROTARY DRILL HOLES & ADITS

ON

COAL LICENCES: 374, 375
392, 393
396, 603
604 & 989

SAGE CREEK COAL
FLATHEAD VALLEY, B.C.

REPORT ON EXPLORATION AND GEOLOGY
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SAGE CREEK COAL
FLATHEAD VALLEY, B.C.

REPORT ON EXPLORATION AND GEOLOGY
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SUMMARY

An exploration programme encompassing bulk sampling and drilling was carried out on the Sage Creek Coal property from late May through December, 1974. The bulk sampling programme was carried out to further analyse and test the coal and to investigate possible oxidation associated with faults. The drilling programme was initiated to enhance geological knowledge, and, to provide sufficient control to establish geological coal reserves with a fair degree of accuracy.

This report outlines the most recent exploration programme only, but incorporates results of previous programmes in an evaluation of all geological knowledge of the Sage Creek Coal deposit.

The results of this and previous programmes have established in situ geological reserves of 146 million long tons and shows the deposit has the potential to sustain a production of 3 million long tons of coal per year for 20 years.

ACKNOWLEDGEMENTS

The writer wishes to acknowledge the assistance of J. Baker, R. Blakeney, G. Switzer and R. Talbot who were employed as assistants to the writer during the drilling programme. The writer would also like to acknowledge the assistance and consultations of W. J. Hennessey who has been our consultant since initial investigation began in 1970.

The adit and bulk sampling programme was under the supervision of P. Bedford and B. Pewsey and much of the data concerning this aspect of the report may be attributed to them.

The writer also wishes to acknowledge the assistance and advice rendered by R. A. Benkis who is also responsible for the chapter on coal reserves.

R. Poon, T. Prentice and E. Chappell carried out the tests in the field laboratory maintained in Fernie.

INTRODUCTION

Exploration at Sage Creek Coal, by Rio Tinto Canadian Exploration Limited, commenced in the fall of 1970 and has continued to the present time. The property has been investigated by mapping, trenching, drilling, probing and aditing. To date 78 holes for approximately 51,000 feet have been drilled and 12 adits consisting of approximately 4,000 feet of drifts and cross cuts have been excavated. Approximately 340 tons of coal have been mined to provide samples for analysis, testing and market studies.

The most recent exploration programme was carried out from late May through December 1974. Details of this programme are presented in this report. For details concerning prior exploration activity the reader is referred to previous reports by the writer.*

The camp for the programme was established along Cabin Creek, approximately one quarter mile west of the confluence of Cabin and Howell Creeks. The contract for providing the camp and catering was awarded to McMeekin Construction Ltd. of Rocky Mountain House, Alberta.

McMeekin was also awarded the contract to construct and maintain all access roads, adit sites and drill sites. One D-8 'cat' was mobilized to carry out support for the adit programme. Later two more 'cats', a D-8 and a D-7E, were mobilized to lend support to the drilling programme. Blasting of conglomerate was necessary to assist construction of a main access road up the east slope of North Hill. The blasting was done by Trina Maree Mining Ltd. of Blairmore, Alberta.

McElhanney Surveying & Engineering Ltd. of Calgary provided all survey control for locating access roads, drill sites and adits and accurately surveyed the adits and drill holes upon completion.

Weather conditions during the summer months were warm and dry with little precipitation recorded. The first snow fell during the latter days of September but lasted for only a few days. The accumulation of snow began in early November. Approximately 72 inches fell before demobilization of the camp on December 30. Paul Robins of Elko, B.C. was awarded the contract to plow and maintain the main access road from camp to Fernie.

* Refer to references listed later in report.

Mapping along new access roads and drill sites was carried out until early November when further mapping was curtailed by snow.

ADIT PROGRAMME

The adit programme commenced on May 27th and continued to mid-August, 1974. The purpose of the adit programme was threefold:

1. To provide a sample from Seam 4 (upper) from the north slope of South Hill.

2. To investigate for possible oxidation of the seams adjacent to fault contacts.

3. To provide additional samples from all seams for further testing and for further marketability studies.

To this end, two adits, for a total of 850 feet of drifts and cross cuts, were excavated into Seam 4 on the north slope of South Hill. A total of approximately 200 tons of coal was extracted from these and several pre-existing adits to provide the required samples.

Adit 74-4F-S

This adit is located on the north slope of South Hill at coordinates (U.T.M grid in feet) 17,848,301N and 583,838E and at an elevation of 4,907 feet above sea level. The primary purpose of this adit was to intersect a fault and to test the coal adjacent to the fault for oxidation. A fault was encountered after driving the adit for 270 feet along strike. The fault contact was followed to 380 feet where further penetration into the hill was stopped due to unstable ground conditions. A bulk sample (74-4F-S) of 10.4 tons was taken from along the fault contact.

A cross cut at 150 feet in from the portal exposed the seam from footwall to hanging wall. Separate samples of approximately 28 tons and 22 tons were taken from Seam 4 Upper (74-4U-S) and Seam 4 Lower (74-4L-S) respectively.

The seam as exposed in the cross cut was measured by W. Hennessey to be 51.25 feet which includes Seam 4 Upper at 27.7 ft., Seam 4L at 19.25 ft. and the separating shale parting at 4.3 ft. A stratigraphic profile of the seam at 1" = 5' is attached. Also attached is a tape and compass plan of the adit

at 1" = 10' indicating a geological interpretation. (Maps DWG. G-3504-1 and G-3504-2).

Adit 74-4A-S

This adit is located on the north slope of South Hill along the same stretch of road as adit 74-4F-S and approximately 1,000 feet west. The portal is located at coordinates 17,848,465N and 582,965E, and at an elevation of 5,001 feet above sea level. The purpose of this adit was to intersect a known fault and test the coal adjacent to the fault for oxidation. The fault was exposed along the road approximately 30 feet west of the portal and was encountered in the adit after driving 47 feet into the seam. The drift of the adit was advanced to 160 feet where a cross cut from the hanging wall to the fault was excavated. A sample (74-4A-Fault-S) of 10.4 tons was extracted from the cross cut.

The seam as exposed in the cross cut was measured by W. Hennessey to be 17.65 feet and represents the upper two thirds of Seam 4U. The lower third of Seam 4U and Seam 4L are displaced by the fault which is steeply dipping to the east and down dropped to the east. The seam exposed at the portal was measured as 25.5 feet.

A stratigraphic profile of the cross-cut at 1" = 5' is attached. Also attached is a tape and compass plan of the adit at 1" = 10' indicating a geological interpretation. (Map DWG. G-3505).

Bulk Samples from Pre-Existing Adits

Existing adits on both North and South Hills were re-opened and bulk samples extracted for further washability tests and marketing studies. These adits and samples are listed below:

Seam 2 on North Hill	-	Adit 72-2-N	- 24 tons
Seam 4U on North Hill	-	Adit 72-4-N	- 15 tons
Seam 4L on North Hill	-	Adit 72-4-N	- 8 tons
Seam 5 on North Hill	-	Adit 72-5 New-N	- 21 tons
Seam 2 on South Hill	-	Adit 73-2-S	- 20 tons
Seam 5 on South Hill	-	Adit 73-5a-S	- 42 tons

The coal was monitored at our field laboratory, maintained in Fernie, at every 10 feet of advancement in the adits. This was carried out basically as a check on oxidation and to assist in determining a suitable location for cross cutting the seams.

The bulk samples were sent to Birtley Engineering (Canada) Ltd. in Calgary for analysis and washability tests. Further tests for oxidation on the washed coal were carried out by the Department of Energy, Mines and Resources in Ottawa.

The adit excavations and bulk sampling were carried out by Trina Maree Mining Ltd. under sub-contract to McMeekin Construction.

The results of the testing are revealed in reports from Birtley Engineering and are not dealt with in this report, suffice to say the quality of the coal is consistent with previous testing and that coal adjacent to fault contacts was found to be unoxidized.

DRILLING PROGRAMME

The drilling programme commenced August 24, 1974, with the preparation of access roads and drill sites on South Hill. Three rigs were required to carry out the programme and were mobilized September 3, 13 and 28 respectively. Two of the rigs were capable of drilling to depths up to 1,300 feet, whereas the third rig had a depth capacity of 500 feet. Holes drilled to a total depth of less than 500 feet were completed by October 19, and the small rig was demobilized.

Drilling on South Hill was completed October 25, and on North Hill, December 23.

The purpose of the drilling was to:

1. Enhance geological knowledge.

2. Establish and substantiate geological coal reserves.

3. Provide quality and raw ash control throughout the deposit.

To provide this information, the drilling was

carried out on an 800-foot by 800-foot grid pattern. Forty-seven (47) holes for an aggregate of 31,400 feet were drilled. Eighteen (18) of the holes for 12,310 feet were drilled on South Hill.

Control on raw ash content of the coal was provided from density logs whenever down hole conditions permitted open hole logging. This method was monitored by coring the coal horizons in three holes and determining actual raw ash.

Muds were used to improve stability of hole wall conditions and to minimize sloughing, thereby increasing the probabilities of open hole logging.

The drilling contract was awarded to Becker Drills Limited of Calgary.

The mud service contract was awarded to Shaw Exploration Services Ltd. of Calgary, however, was re-awarded to Becker Drills three weeks into the programme.

The coring was carried out by Challenger Rentals of Edmonton under sub-contract to Becker.

All geophysical probing was done by Roke Oil Enterprises Ltd. of Calgary.

Drilling Method

The drilling rigs were truck-mounted C.S.R. (conventional seismic rotary), equipped with 4½" O.D. dual-walled pipe to drill with mud or air. Reverse circulation methods were used when drilling with air. The diameter of the holes drilled were 4-7/8" to 5-1/8".

Drilling with mud proved more satisfactory than with air for obtaining maximum hole stability and minimum sloughing. Muds were used to drill all holes, however, several holes had to be completed with air due to severe loss of circulation problems.

Sampling

Representative grab samples were collected at five-foot intervals. The samples were washed, logged and retained in vials for future reference. The samples were used in conjunction with gamma ray/neutron logs for correlation and determination of contact relationships, thereby helping to develop a stratigraphic and structural interpretation.

Coal was collected continuously throughout the intersected interval and sampled in two-foot increments.

The use of muds in the drilling complicated the sampling procedure as the consistency of the muds prevented easy separation from the coal. The coarse coal fraction was separated from the muds through a 40 mesh screen mounted on a shale shaker. The underflow was diverted to a trough lined with a 200 mesh nylon screen where the mud solution was diluted to allow it to pass through the screen. The fine coal fraction retained in the screen was collected only when the entire seam had been drilled. This method was slow and proved impractical with the arrival of cold weather. Modifications to the method were made and adopted. The mud solution was thinned when a coal seam was intersected. Bags made from 200 mesh nylon screen material were placed over the fluid return outlet and extended across the shale shaker so that all returns had to pass through the bag. The vibrations of the shaker assisted passage of the mud through the bags, however, the process was slow and drilling was frequently interrupted to allow the bags to drain.

The coal samples were weighed, logged and shipped to the field laboratory in Fernie.

Downhole Geophysical Logging

All holes were logged with Gamma Ray/Neutron probes. The logs were used to assist correlation, define lithology, and, in particular, establish coal seam contacts.

All holes were logged by Sidewall Density, Caliper and E-Log probes whenever downhole conditions permitted. The Density Log was used to evaluate the raw ash content of the coal seams and to establish coal seam contacts. Because of the sensitivity of the Density probe to downhole caving, the Caliper was run to monitor the hole wall. In holes where excessive caving was indicated, the Density Logs could not be used for raw ash determinations. The E-Log was run to determine the porosity of a given coal horizon.

Copies of all logs are attached to the report in Appendex A.

Hole Deviation Surveys

Deviation Surveys were run in 8 holes as a random check to the angle and direction of deviation of the holes from the vertical. The results of the survey are tabulated below and for the most part, indicate only minimal drifting.

TABLE I

DEVIATION SURVEYS

	Run No. 1		Run No. 2		Run No. 3		Run No. 4	
Hole	Depth	Dip & Dir	Depth	Dip & Dir.	Depth	Dip & Dir.	Depth	Dip & Dir.
74-24	455'	5° @ 81°						
74-33	200'	3° @ 334°	400'	4.5°@ 91°	650'	9° @ 80°		
74-37	200'	0.75°@ 91°	452'	1° @ 172°	810'	5.5°@ 221°		
74-41	300'	2° @ 201°	600'	2.5°@ 261°	900'	5° @ 81°		
74-42	250'	4.75°@ 296°	500'	6° @ 391°	700'	4° @ 316°	890'	9° @ 326°
74-45	200'	2.75°@ 231°	700'	2.25°@ 171°	1000'	2.75°@ 121°		
74-49	200'	5° @ 286°	600'	7.5°@ 331°	900'	14°@ 346°		
74-50	200'	3° @ 241°	600'	7° @ 241°	1000'	3.5°@ 251°		

Coring

Coal horizons in 3 holes were cored as a check to raw ash determination from density logs. The holes selected for the coring were 74-11 on South Hill and 74-37 and 74-43 on North Hill.

The coring was carried out using the rotary rigs and conventional oil field methods of coring. A string of 5-13/16" pipe was mobilized to use with wireline core barrels. Three inch core was recovered contained in a 3½" inner plastic liner. A 6-3/4 inch tungsten carbide blade bit was used to core the coal intervals. Because of the hole size and the weight of the drill stem drilling of these holes was slow and costly.

Coring the coal was achieved without difficulty with a recovery of greater than 97%. However, attempts to core rock partings and footwall rock were unsuccessful. The failure to core the rock was due mainly to equipment; the equipment required to successfully core coal was inadequate for rock.

The core was logged, broken into 2-foot samples and shipped to Birtley Engineering for analysis.

GEOLOGY

(Map DWG G 4449)

The coal measures in the area occur in the Kootenay Formation and were deposited during the late Jurassic and/or early Cretaceous periods. The Kootenay Formation is the host formation for all the economically significant coals throughout the Crowsnest Pass and Fernie Basin areas.

The Kootenay Formation in this area lies in the upper plate of the Lewis Thrust and was preserved from erosion by subsequent down faulting between two resistant blocks; the Clark Range to the east and the MacDonald Range to the west. Locally the Formation occurs on the east flank of a northwest trending anticline, the apex of which passes under the MacDonald Thrust to the west of South Hill. The strata strike north to northeast and dip east at approximately 30 degrees.

The prevailing structure across the area is northwest trending normal faults, generally down thrown to the west. The most prominent of these is the Flathead Fault which lies along the west side of the Clark Range and marks the east limit of the Kootenay Formation. The displacement against this fault is approximately 20,000 feet. The Harvey Fault approximates Howell Creek in the property area and marks the northeast limit to the Kootenay Formation. The Harvey Fault is probably associated with, or a splay from, the Flathead Fault and has an inferred displacement of 1,200 feet.

The western limit to the Kootenay Formation is established at the interface with the present topography.

Stratigraphy

The Kootenay Formation consists of a non-marine sequence of strata which rests conformably on the underlying marine shales and siltstones of the Fernie Group. The thickness of the formation in the property area varies from 650 to 800 feet.

The Kootenay Formation consists of fine to conglomeratic sandstones, siltstones, shales and coal seams, deposited under varying and recurring conditions (bog to turbulent) of a fluvial and/or deltaic environment. The Formation is defined by a characteristic sandstone unit at its base, usually from 40

to 80 feet thick, and by the basal conglomerate unit (stratigraphically equivalent to the Cadomin Formation) of the Blairmore Group lying disconformably above the Kootenay Formation. The character of the intervening beds, being lenticular in shape and interfingering laterally, does not allow for the establishment of marker horizons, however, gross patterns of deposition are recognizable. The coal seams are fairly characteristic throughout the property and offer the best means of correlation. Holes 74-49 on North Hill and 74-07 on South Hill have been selected as intersecting complete and typical sections of Kootenay stratigraphy and have been used as 'type sections' for developing correlations.

Coal Horizon 5, the lowest in the stratigraphic sequence, rests on the basal sandstone unit and has an average true thickness of 35 feet. The horizon is generally split into two benches by a carbonaceous shale unit of variable thickness, usually from 3 to 8 feet. The coal horizon thins and becomes markedly shalier towards the southwest on South Hill. The thinning is mainly attributed to shaling out of the upper part of the upper bench (*Stratigraphic correlation chart, DWG MISC 2699-2*). An anomalous zone, approximating grid line 586,000 E, indicates a thickening of Horizon 5 and the development of two distinct seams. The thickening is mainly in the parting between the two benches and does not tend to increase or reduce reserves. (Section 586,000 E).

Coal Horizon 4 lies typically 180 to 220 feet above Horizon 5. Intervening strata is generally comprised of fine clastics, shale to very fine grained sandstones, with local developments of medium grained sandstone lenses.

A zone of carbonaceous shale, shaly coal and few thin coal bands is developed approximately 120 to 150 feet above Horizon 5. This zone is nearly always apparent and in restricted local areas may contain seams sufficiently developed to be economically significant.

Coal Horizon 4 occurs as two distinct benches and, on North Hill these benches form separate seams; Seam 4 Upper and Seam 4 Lower. The average thickness of Seam 4 Upper is 27 feet and of Seam 4 Lower, 20 feet. The parting varies in thickness from a minimum of 3 feet in the south slope of South Hill to a maximum of 40 feet in the northeast slope of North Hill. A further split in the lower bench develops towards the south and southwest on South Hill. (Stratigraphic correlation chart DWG MISC 2699-1). In hole 74-43 A on the east slope of North Hill, Horizon 4 has 3 benches. The lower bench is 10 feet thick and is interpreted to be a local development within a predominantly carbonaceous

shale sequence underlying Seam 4 Lower. (Section 17,853,460N). North of a line approximating grid line 17,856,660N at the north end of North Hill, Seam 4 Lower appears to thin and shale out. In hole 74-24 this seam is reduced to two feet thick and at adit 73-4-N is unrecognized.

The greatest variation in stratigraphy occurs between Seam 4 and Seam 2; this interval is 240 feet (hole 74-01) on the north slope of South Hill and 40 feet (hole 74-28) on the northeast slope of North Hill.

On the South Hill the interval is characterized by the development of two distinctive, massive, medium to coarse grained sandstone units separated by interbeds of shale and siltstone with few carbonaceous to coaly bands. These sandstone units are recognized in drill holes on the southeast slope of North Hill but disappear to the north and west. The lower sandstone unit can be traced as far north as grid line 17,855,060N before shaling out. The disappearance of the upper sandstone and the thinning and shaling out of the lower sandstone in a northward direction, together with a substantial thinning of the strata between seams 4 and 2 suggests a fairly widespread erosion surface prior to deposition of Seam 2.

Seam 3 encountered in drill hole S.C.C. 2, sixteen feet below Seam 2, could be a remnant of an eroded seam or a local development on the erosion surface. This seam appears to merge with Seam 2 to the north to form a lower bench of Horizon 2. (Stratigraphic Correlation Chart Dwg. Misc. 2699-1).

Coal Horizon 2 has an average thickness of 10-12 feet and varies from 5 feet on the south slope of South Hill to 15 feet at the north end of North Hill. The horizon attains maximum development across the centre of North Hill through holes S.C.C. 5, 74-41, 74-42 and 74-43A, where the horizon is separated into two benches (the lower possibly representing Seam 3) and attains a total thickness of 32 feet (hole 74-41).

The strata between Horizon 2 and the basal Blairmore conglomerate is indicative of cyclic deposition. Two massive, medium to coarse grained sandstone units of similar character and thickness are bounded above and below by carbonaceous to coaly zones. The lower of these zones encompasses Seam 2. The zone separating the sandstone units contains Coal Horizon 1.

Coal Horizon 1 is generally represented by a 20 to 30 foot zone containing coal in bands usually less than two feet

thick and comprising less than 20% of the interval. Locally, some of these bands may have merged or thickened to form a seam of about 5 to 6 feet, however, these areas are few and of limited extent and precludes the use of this horizon in an economic evaluation.

Another carbonaceous to coaly zone developed between the upper sandstone and conglomerate is less developed than Horizon 1 and has no economic significance.

The only facies of the Blairmore Group recognized on the property is the basal conglomerate and is restricted to the east slope area of North and South Hills. Younger Blairmore deposition appears to have been eroded.

Underlying a flat-lying area on the west bank of Howell Creek are recent deposits of till and gravel resting unconformably on the Kootenay and Blairmore formations. These deposits may attain a thickness of several hundred feet; 250 feet of gravel was intersected in drill hole 74-32.

The Kootenay and Blairmore formations are truncated to the south and southeast on South Hill against Tertiary deposits of clays, marls and loosely consolidated gravels of the Kishenehn Formation. The erosional unconformity plunges to the southeast at 30 degrees to 40 degrees from a surface trace trending NE-SW closely paralleling a line passing through holes 74-17 and 74-11. In drill hole 74-15, 800 feet of Kishenehn deposits were intersected before entering lower Kootenay strata; hole 74-20 was abandoned at 820 feet, still in Kishenehn deposits.

Structure

Normal faults subparallel to and probably associated with the Flathead and Harvey Faults* form the prevailing structure across the property. For the most part, the faults dip steeply to the west with downthrow to the west; only three east-dipping faults, two on South Hill and one on North Hill, have been recognized, all with downthrow to the east. Faulting is more prominent across South Hill where the cumulative stratigraphic displacement against all the faults is approximately 2,500 feet. Individually, the throw against the faults generally is less than 200 feet but may reach 800 feet along at least one fault passing to the west of Stelco drill hole 4.

Minor thrusting and adjustment faulting is observed in outcrop with displacements ranging from a few inches to a few feet. These disturbances are probably local and cannot be traced

* Refer to Page 9, Paragraph 3.

along strike and may be associated with glacial and slump structures. Similar structures are to be expected at random throughout the property.

East-west cross sections at 200 feet to the inch have been constructed across the property at 400-foot intervals; sections at 800-foot intervals are attached to the report. Two north-south sections, 586,000E on North Hill and 583,000E on South Hill, have been constructed and are attached.

Structure contour maps have been developed for each of seams 2, 4 and 5 and are attached to the report.

North Hill is considered to be structurally simple with few recognized faults. One fault, recognized through drill hole intersection, trends approximately N-S and passes through drill holes 74-50 and 74-42. The apparent throw against this fault is approximately 150 feet at hole 74-50 and diminishes northward to an inferred origin in the vicinity of hole 74-33.

A minor fault with a displacement of 10 feet to 15 feet cuts Seam 2 in a road cut between hole 74-33 and 74-30 and could be an extension or offshoot of the above fault.

An east-dipping normal fault trending NW-SE is interpreted from drilling results and topographic expression, and is intersected in holes 74-24, S.C.C. 6 and 74-32. The apparent displacement against this fault is approximately 250 feet in hole 74-32 and diminishes northward to 150 feet in hole 74-24. Evidence for the fault is found along the access road to hole 74-24 where it crosses the large gully 300 feet west of the drill site. Subparallel to this fault and to the east are two intersecting west-dipping normal faults passing through and close by to the west of hole 74-25. The faults appear to diverge to the northwest. The total apparent stratigraphic separation against these faults is approximately 250 feet at hole 74-25.

Other faulting in this area may become apparent as the Harvey Fault to the northeast is approached. Small faults with displacements of a few feet are recognized along access roads at the northeast end of North Hill.

Possible minor faulting on the south slope of North Hill may be associated with difficulties relating subsurface intersections of Seam 5 with known surface exposures. A 10 degree to 15 degree swing in strike and a bunching of the structure contours is necessary to tie in the surface trace of the seam with structure contours delineating the base of Seam 5. Structural disturbances

toward the footwall contacts were encountered in two adits driven into the seam at this location during the summer of 1972. It is thought possible that a décollement structure might exist between Seam 5 and the basal sandstone.

Two small faults, with displacement of a few feet, have been mapped on the south slope between adit 72-2-N and hole 74-48 and west of adit 72-4-N.

South Hill, by comparison, is structurally complicated. Ten north to northwest-trending faults are recognized or inferred to cut the east slope of South Hill between grid lines 581,000E and 585,000E. The faults tend to divide the hill into several fault blocks, each up thrown to the east relative to the other and have the effect of returning the coal-bearing strata to the surface. The displacement against the faults varies from 20 to 250 feet.

Five of the faults have been identified in outcrop along the north slope of South Hill. A low angle fault is located along the access road 400 feet west from adit 73-2-S where an attitude of 360 degrees/42 degrees W was measured. It is conjectured this fault intersects holes 74-04, SCC 29 and probably SCC 28. The displacement against this fault is approximately 80 feet. East of this fault no disruption to the stratigraphy is recognized within the present pit configuration.

A large fault between holes S.C.C. 1 and 74-01 cuts the major access road approximately 600 feet east of adit 74-4A-S. Although not positively identified, the fault is inferred from the repetition of stratigraphy and is restricted to a 100-foot section along the road through which it could pass. It is conjectured that this fault intersects holes 74-01 and S.C.C. 22. A minor fault or splay from this fault was intersected in adit 74-4F-S. Three small faults were mapped in the footwall of Seam 4 just to the west of this adit and are interpreted as splays of the fault intersected in the adit. (Dwg. G-3504-1 and 3504-2).

The fourth fault is a steep, east-dipping fault with downthrow to the east. The fault is intersected in adits 73-5-S and 74-4A-S and outcrops along the road 40 feet west from the second adit. Inferred displacement against this fault is approximately 100 feet.

The other fault identified in outcrop is approximately 450 feet west of adit 74-4A-S at a "dogleg" in the main access road. This fault is also identified on the next road above,

where it cuts the footwall of Seam 4. The inferred displacement against this fault is approximately 150 feet.

The southward projections of these faults are obscured by surficial deposits and are located from projecting drill hole intersections and from photogrammetry.

The remaining faults are not recognized at the surface and are inferred from apparent offsets in surface stratigraphy and/or from apparent loss of stratigraphic sections determined from drill holes. The latter reason for invoking a structural interpretation is enhanced from breaks in the continuity of structure contours. The surface traces of these faults are plotted from projecting drill hole intersections and from photogrammetry.

A small thrust fault, mapped during reconnaissance mapping in 1970 on the north slope of South Hill, approximately 500 feet north from hole 74-03, was apparently intersected in hole 74-03 at a depth of 204 feet. A repetition of 22 feet of strata is indicated.

The area west of grid lines 581,000E and south of 17,845,260N on South Hill has not been explored sufficiently to determine the structure or establish coal reserves. It is known that the area is underlain by Kootenay strata and has the potential of considerably increasing the reserves of South Hill

COAL

Three economically significant seams are identified on the property; Seam 5 - the lowest in the stratigraphic section - has an average thickness of 35 feet; Seams 4 Upper and 4 Lower have average thicknesses of 27 feet and 20 feet respectively; and Seam 2 - the highest in the stratigraphic section - has an average thickness of 10 to 12 feet.

The stratigraphy of the seams has been discussed previously in the discussion on 'stratigraphy' and will not be repeated here.

Quality

Determination of coal quality has been obtained from drill cuttings, drill core and bulk samples. Analytical tests on the coal have been carried out in our field laboratory, and by Birtley Engineering (Canada) Ltd. in Calgary.

Consistency in quality of the seams is apparent throughout the deposit, notwithstanding the high raw ash from drill cuttings, regardless of the sampling method.

The coal has been established as medium volatile bituminous with the propensity to coke.

Proximate analysis of each seam is tabulated below for:

(a) raw coal at 3" x 0" and,

(b) a float at: (i) s.g. 1.6 for Seam 2,

(ii) s.g. 1.42 for Seams 4 Upper and 4 Lower,

(iii) s.g. 1.43 for Seam 5.

The corresponding geological sections are attached to the report as illustration Dwg. G-3506.

TABLE II

PROXIMATE ANALYSIS OF COAL SEAMS

(a) Raw Coal

	Seam 2 (from adit 72-2-N)	Seam 4U (from adit 72-4-N)	Seam 4L (from adit 72-4-N)	Seam 5 (from adit 73-5a-S)
Ash	20.7%	19.7%	26.9%	36.6%
R.M.	0.9%	1.4%	1.2%	1.0%
V.M.	21.1%	22.8%	20.4%	19.8%
F.C.	56.5%	56.5%	51.0%	42.1%
Sulphur	0.83%	0.48%	0.56%	0.53%
F.S.I.	5½	2½	2	2½

(b) Float Analysis

	Seam 2 (from adit 72-2-N)	Seam 4U (from adit 72-4-N)	Seam 4L (from adit 72-4-N)	Seam 5 (from adit 73-5a-S)
Yield	78.5%	61%	40%	34%
Ash	7.5%	7.7%	9.8%	8.6%
R.M.	1.1%	1.0%	1.0%	0.8%
V.M.	22.9%	21.8%	23.8%	24.1%
F.C.	68%	69.2%	66.4%	66.4%
Sulphur	0.54%	0.35%	0.58%	0.56%
F.S.I.	7½	4½	5	5½
B.T.U.'s	14,150	14,190	13,900	14,190

Details of the testing and results thereof are revealed in reports from Birtley Engineering and are not dealt with in this report.

Determination of Raw Ash

Raw ash determinations of the coal seams were derived from bulk samples, drill core and density log results. Raw ash determined from drill cuttings tended to be high and is not considered to represent a true analysis of the seam. The high raw ash content in the cuttings is probably due to:

(a) contamination caused by downhole caving;

(b) the drilling method of returning cuttings to the surface in a fluid medium between the pipe and hole wall. This method probably induces plucking from the hole walls and causes the loss of some of the fine coal to suspension in the fluid system;

(c) unrepresentative sampling due to differential sloughing within the coal seams.

The control on the raw ash content of seams intersected by rotary drilling was determined from sidewall density log results. The density log recorded bulk density or in situ specific gravity of the formation wall. Raw ash was read directly from a graph relating bulk density (in situ specific gravity) to raw ash. The graph was empirically derived from plotting actual raw ash content of core and bulk samples against the bulk density or in situ specific gravity recorded by the density log in those holes in which the coal was cored and from holes drilled close to the bulk sample points. Because bulk density determinations using the density probe are affected by down hole sloughing, drilling fluid and changes in interstitial waters, ultimate ash values cannot be determined. Sufficient reliability, however, can be placed on the above method to achieve order of magnitude accuracy (plus or minus five per cent) and to establish consistency of raw ash relative to bulk samples and core.

Field Laboratory

A field laboratory was maintained in Fernie to monitor the coal at every 10 feet of advancement in the adits. Tests carried out in the laboratory were:

1) F.S.I. and ash determinations for raw coal.

2) Float/sink at s.g. 1.5 using carbon tetrachloride.

3) F.S.I. and ash determinations for the float fraction.

4) Geisler Plastometer of the float fraction.

Field Laboratory (Cont'd.)

5) F.S.I. for the sink fraction.

During the drilling programme the laboratory was used to carry out the same tests on the drill cuttings. The samples were then sent on to Calgary for further testing by Birtley Engineering.

COAL RESERVES

In situ geological raw coal reserves for North Hill and South Hill have been calculated and tabulated separately. For this exercise the apparent seam intervals from the bore hole logs were converted to true thickness assuming that the strata have a uniform dip of 30°. Only coal horizons having a true thickness of 5 feet or more have been included in the reserves. Shale partings of less than 5 feet true thickness have also been included in the reserves; shale partings exceeding 5 feet have been omitted from the calculations. The following long-ton (2,240 lbs) factors were used in the calculations:

Seam #2	25.4 cubic feet/ton
Seam #4	24.0 cubic feet/ton
Seam #5	22.0 cubic feet/ton
Shale:	18.2 cubic feet/ton

These factors were derived considering the specific gravities of the materials involved. Tests by Birtley Engineering Ltd. have indicated that the average specific gravity of Seam #2 is 1.41, Seam 4 (Upper and Lower) 1.50, and Seam 5 1.63; the specific gravity of the shale partings was considered to be 1.97.

For the North Hill the in-situ reserves were calculated for an area between lines 17,850,860N and 17,858,060N. Two down-dip cut-offs have been used: 3,900 feet above sea level and 3,400 feet above sea level.

On the South Hill the reserves were calculated for the area between lines 17,844,460N and 17,848,860N and down-dip cut-offs of 3,900 feet above sea level and 3,600 feet above sea level.

Three categories have been used to describe the reserves: proven, probable and possible.

The proven reserves are considered to lie between the outcrop trace of Seam 5, and a point 200 feet east from the most easterly drill hole in each section. On both hills the northern and southern cut-off boundary is 200 feet north or south from the last respective section. Additional work in the proven area is not expected to alter the calculated reserves by more than 20%.

Probable reserves are those which are not supported by direct bore hole evidence, but are interpreted from geological evidence. On North Hill, probable reserves are considered to lie in a 400-foot wide strip between lines 17,857,660N and 17,858,060N and in an 800-foot wide strip centered on line 17,854,260N between holes 74-37 and 74-39 (Seams #4 and #5 only); the reason here is that hole 74-39 was terminated short of the two major seams and Seam #2 did not indicate any abnormal geological behaviour of the coal horizons in this area. On South Hill, probable reserves lie in two 200-foot wide zones between lines 17,845,260N and 17,845,060N, and 17,848,460N and 17,848,660N.

Possible reserves are considered to lie between the point 200 feet from the most easterly drill hole along a given section and the down-dip extension of the seam to the particular cut-off elevation.

Total in-situ reserves for all categories based on the above parameters are calculated at:

North Hill

To 3,900 feet above sea level:

Proven	57,897,861	
Probable	3,796,088	
Possible	2,763,679	
TOTAL	64,457,628	long tons

To 3,400 feet above sea level:

Proven	68,633,264	
Probable	6,173 609	
Possible	17,030,181	
TOTAL	91,837,054	long tons

South Hill

To 3,900 feet above sea level:

Proven	33,293,427	
Probable	7,159,052	
Possible	8,391,855	
TOTAL	48,844,334	long tons

To 3,600 feet above sea level:

Proven	36,412,181	
Probable	7,293,188	
Possible	12,050,428	
TOTAL	55,755,797	long tons

A summary of the reserve calculations by sections is outlined in Tables III to VII inclusive.

CONCLUSIONS

1) Reserves of 147 million long tons have been established and show the deposit has the potential to sustain a production of 3 million long tons of coal per year for 20 years.

2) The coal has been established as medium volatile bituminous with the propensity to coke.

3) There is sufficient control on geology to design a preliminary pit but is insufficient for a detailed mining plan.

4) Additional drilling, within the area drilled off on the 800' x 800' grid will not appreciably alter geological reserves.

5) The geological structure on South Hill is more complex than on North Hill.

RECOMMENDATIONS

1) The coal reserves should be upgraded to the proven classification by completing and expanding the 800' x 800' grid drill pattern within the proposed pits outlines.

2) The control of raw ash content in the coal seams should be enhanced to fill in the voids where:

(i) the grid drilling is to be completed or expanded;

(ii) seams were not intersected in previous drilling due to faulting;

(iii) seams were intersected but because of hole conditions no sample was recovered and no density log is available.

3) More control on stratigraphy and raw ash of the coal seams should be obtained by coring the coal horizons in selected holes.

4) Geotechnic and hydrologic information should be obtained to justify basic assumptions used in generating pit configuration and to establish mineability. This information will be obtained from:

(i) drilling - to recover undisturbed samples of pit hanging wall material;

- to attain core of the pit footwall rock;

- to attain information on rock and overburden permeability, water flow and water quality;

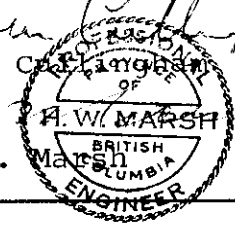
(ii) aditing - to drive one adit to examine pit footwall rock conditions.

5) To investigate fault contact relationships by driving an adit across a known fault or fault zone.

Toronto, Ontario
May, 1975

Owen Cartwright

H. W. Marsh



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APPENDIX B

RIO ALGOM MINES

1974 Drill Program

Final Coordinates for 1974 Holes, 1973 Holes and Existing Adits

HOLE NO.	ELEVATION	NORTHING	EASTING
7401	5206	848,128	583,295
7403	5224	847,862	582,808
7404	5049	847,868	584,399
7405	5365	847,072	581,996
7406	5147	847,054	583,602
7407	4918	847,062	585,205
7408	5505	846,197	581,172
7409	5289	846,624	582,601
7410	4966	846,244	584,408
7411	4808	846,287	585,224
7412	4581	846,263	585,978
7413	5597	845,410	581,177
7414	4996	845,480	583,994
7415	4657	845,473	585,990
7416	5242	844,650	581,983
7417	5086	844,661	582,800
7418	5011	844,668	583,607
7420	4797	844,644	585,188
7421	4649	858,252	586,008
7422	4460	858,203	586,783
7423	4944	857,438	585,257
7424	4847	857,421	586,008
7425	4490	857,457	586,726
7426	5170	856,591	584,376
7427	4900	856,684	585,983

HOLE NO	ELEVATION	NORTHING	EASTING
7428	4375	856,672	587,617
7429	5209	855,838	584,301
7430	4965	855,862	585,206
7431	4560	855,833	586,825
7432	4407	855,863	587,602
7433	4798	855,431	585,998
7434	5320	855,049	584,369
7435	4449	855,031	587,614
7436	5284	854,249	583,688
7437	4762	854,242	586,037
7439	4410	854,250	587,603
7440	5192	853,263	583,870
7441	5132	853,538	585,221
7442	4773	853,475	585,976
7443	4498	853,389	586,810
7443A	4498	853,386	586,804
7444	5191	852,671	584,420
7445	5053	852,580	585,151
7447	4472	852,613	586,791
7448	4827	851,924	584,401
7449	4829	851,751	585,297
7450	4643	851,893	585,980
7451	4466	851,056	584,398

Page 3 Rio Algom Mines, 1973 Drill PROGRAM

HOLE NO	ELEVATION	NORTHING	EASTING
21	5227	847,476	583,160
22	5162	847,557	583,651
23	5301	845,534	582,335
24	5127	845,453	583,367
25	4432	847,139	586,324
26	4558	847,891.9	585,738.1
27	4847	847,960	584,898
28	4841.7	845,529.58	584,891.12
29	5058	847,144	584,448
30	4870	848,224	584,180
31	4703	848,599	584,214
32	4574	857,381	586,561

HOLE NO.	ELEVATION	NORTHING	EASTING
73-2-S	4793	847,999	584,956
73-4-S	4781	848,431	584,130
73-5-S	4692	849,014	585,049
73-5a-S	4569	848,815	584,274
74-4-F	4907	848,301	583,838
74-4-U	5001	848,465	582,965
5 (New)	4943 (4939)	852,791	583,705
73-2	4493 ($\pm$10' cover 4483)	857,504	586,718
73-4-N	4639	857,812	586,105
73-4a-N	4531 (4525)	857,838	586,463
Old, Old, Old Well (Near 7419)	4875	844,539	584,453

NORTH HILL

GEOLOGICAL RESERVES FROM OUTCROP to 3,900' ABOVE SEA LEVEL

	SECTION	(1) SEAM 2	(2) No. 3 SHALE	(3) SEAM 2 + SHALE (1) + (2)	(4) SEAM 4U	(5) SEAM 4L	(6) SEAMS 4U + 4L (4) + (5)	(7) No. 4 SHALE	(8) 4U+4L+SHALE (6) + (7)	(9) SEAM 5U	(10) SEAM 5L	(11) SEAMS 5U+5L (9) + (10)	(12) NO. 5 SHALE	(13) 5U+5L+SHALE (11) + (12)	(14) TOTAL ALL SEAMS (1) + (6) + (11)	(15) TOTAL SHALE (2)+(7)+(12)	(16) TOTAL COAL + SHALE (14) + (15)
PROVEN	851.060N	57.630	-	57,630	519.275	364.000	883.375	-	883.375	356.145	423,000	779.145	108.462	887,807	1,720.150	108.462	1.828.820
	851.860N	581.354	-	581,354	1.632.566	1.112.590	2.745.156	-	2.745.156	574.254	669.381	1.243.635	-	1.243.635	4.570.145	-	4.570.145
	852.660N	938.425	-	938.425	1.831.467	1.543.767	3.375,234	68.571	3.443.805	1.051,600	1,099,327	2,150,927	247.604	2,398,531	6.464.595	316.175	6,780,760
	853.460N	1.887.809	136.923	2.024.732	2,322.031	1.167,232	3.489.263	-	3.489.263	1.727.863	2.182.434	3.910.297	62.759	3.973.056	9.287.369	199.692	9.487.051
	854.260N	1.661.069	173.714	1.834.783	2.203.100	1.033,900	3.237.000	-	3,237,000	2.630.436	1.495.090	4.095.526	123.846	4.219.372	8.993.595	297,560	9.291.155
	855.060N	1.223.857	279.409	1.503.266	2.233.415	1.489.298	3.722.713	-	3.722,713	1.376.507	1.197.453	2.573.960	179.230	2.753.190	7.520.530	459.639	7,979.169
	855.850N	803,841	-	803.841	1.791.299	1.298.000	3.089.299		3.089.299	1,654.545	2,054.598	3.709.143	330.856	4.039,999	7,602.283	330.856	7.933.139
	856.660N	1.092.601	94.857	1.187.458	1,651.832	959.732	2.611.564	78.857	2.690.421	2.161.325	752.636	2.913.961	100.000	3.013.961	6.618.126	273.714	6,891,840
	857.460N	300.417	-	300.417	820.875	-	820.875	-	820.875	711.273	1.215.217	1.926.490	-	1.926.490	3.135.782	-	3,135,782
	TOTAL	8,635,011	684.903	9,319,914	15.005.960	6,968.519	23.974.479	147,428	24.121.907	12.214.129	11.089.136	23.303.274	1.152.767	25.456.041	55.912.763	1,985,098	57,897.861
PROBABLE	854.260N	-	-	-	1,129,566	576.000	1.705.566	-	1,705.566	-	-	-	-	-	1.795.566		1,705.566
	857.460N	258.945	-	256.945	547.250	-	547.250	-	547.250	474.182	810.145	1.284.327	-	1.284,327	2,090.522	-	2,090,522
	TOTAL	258.945	-	258.945	1.676.816	576.000	2.252.816	-	2.252.816	474.182	810.145	1.284.327	-	1.284.327	3.796.088	-	3.796.088
POSSIBLE	851.060N	115.276	-	115.276	283.925	145,600	429.525	-	429.525	-	-	-	-	-	544.801	-	544,801
	851.860N	92,220	-	92.220	151.867	51.900	203,767	-	203,767	-	-	-	-	-	295.987	-	295,987
	850.060N	35.024	-	35.024	-	-	-	-	-	-	-	-	-	-	35,024	-	35,024
	857.460N	376.772	-	376.772	837,458	-	837.458	-	837.458	264.728	408.909	673.637	-	673.637	1,887.867	-	1,887,867
	TOTAL	619.292	-	619.292	1.273.250	197.500	1.470.750	-	1.470,750	264.728	408.909	673.637	-	673.637	2,763.679	-	2,763,679
	PROVEN	8,635,011	684.903	9.319.914	15.005,960	8.968.519	23,974.474	147.428	24.121.901	12.224.138	11.089.136	23.303.274	1,152,767	25.456.041	55,912.763	1,985,098	57,897.861
	PROBABLE	256.945	-	258,945	1.676.816	576.000	2.252.816	-	2.252,816	474,182	810,145	1,284.327	-	1.284.327	3.796.098	-	3,796,088
	POSSIBLE	619.292	-	619.292	1.273.250	197.500	1,470,750	-	1,470,750	264.728	408,909	673.637	-	673.637	2.763.679	-	2,763,679
	TOTAL TO 3.900	9.511.248	684.903	10,198,151	17,956.026	9,742.019	27.698.045	147.428	27.845,473	12.953.048	12.308.190	25.261.238	1,152,767	27.414.005	62,472,530	1,985.098	64.457.628

NORTH HILL

GEOLOGICAL RESERVES FROM 3,900' to 3,400' ABOVE SEA LEVEL

	SECTION	(1) SEAM 2	(2) NO. 2 SHALE	(3) SEAM 2 + SHALE (1) + (2)	(4) SEAM 40	(5) SEAM 41	(6) SEAMS 40 + 41 (4) + (5)	(7) NO. 4 SHALE	(8) 40 + 41 + SHALE (6) + (7)
PROVEN	851,060N	-	-	-	-	-	-	-	-
	851,860N	-	-	-	125,066	121,100	246,166	-	246,166
	852,660N	65,512	-	65,512	309,633	286,000	595,633	62,857	658,490
	853,460N	44,221		44,221	375,200	264,467	639,667	-	639,667
	854,260N	162,142	-	162,142	-	-	-	-	-
	855,060N	147,402	-	147,402	648,267	322,667	970,934	-	970,934
	855,860N	155,591	-	155,591	420,567	229,133	649,700	-	649,700
	856,660N	-	-	-	169,867	157,300	327,167	-	327,167
	857,460N	-		-	-	-	-	-	-
	TOTAL	574,868	-	574,868	2,048,600	1,380,667	3,429,467	62,857	3,492,324
PROBABLE	854,260N	-	-	-	800,567	550,400	1,350,967		1,350,967
POSSIBLE	851,060N	165,709	-	165,709	858,700	568,750	1,427,450	-	1,427,450
	851,860N	209,417	-	209,417	955,867	617,035	1,572,902	-	1,572,900
	852,660N	409,449	-	409,449	338,000	212,333	550,333	68,571	618,904
	853,460N	424,189	-	424,189	473,467	104,000	577,467	-	577,467
	854,260N	407,811		407,811	402,533	272,000	674,533	-	674,533
	855,060N	245,669	-	245,669	436,667	177,133	613,800	-	613,800
	855,860N	237,480	-	237,480	461,267	104,000	565,267		565,267
	856,660N	542,866	-	542,866	1,358,933	391,233	1,750,166	-	1,750,166
	857,460N	332,244	-	332,244	804,292		804,292	-	804,292
	TOTAL	2,974,834	-	2,974,834	6,209,126	2,326,494	8,536,219	68,571	8,604,781
	PROVEN	574,868	-	574,868	2,048,800	1,380,667	3,429,467	62,857	3,492,324
	PROBABLE			-	800,567	550,400	1,350,967	-	1,350,967
	POSSIBLE	2,974,834	-	2,974,834	6,209,126	2,326,484	8,536,210	68,571	8,604,781
	TOTAL 3,900-3,400	3,549,702	-	3,549,702	9,059,093	4,257,551	13,316,644	131,428	13,448,072
	TOTAL OUTCROP to 3,900'	9,513,248	684,903	10,198,151	17,956,026	9,742,019	27,698,045	147,426	27,845,471
	TOTAL 3,900' to 3,400'	3,549,702	-	3,549,702	9,059,093	4,257,551	13,316,644	131,429	13,448,072
	TOTAL OUTCROP to 3,400'	13,062,950	684,903	13,747,853	27,015,119	13,999,570	41,014,689	278,855	41,293,545

	SECTION	(9) SEAM 50	(10) SEAM 51	(11) SEAM 50 + 51 (9) + (10)	(12) NO. 5 SHALE	(13) 50 + 51 + SHALE (11) + (12)	(14) TOTAL ALL SEAMS (3)+(6)+(11)	(15) TOTAL SHALE (2) + (7) + (12)	(16) TOTAL COAL + SHALE (14) + (15)
PROVEN	851,060N	68,236	99,000	167,236	23,077	190,313	167,236	23,077	190,313
	851,860N	384,145	317,050	701,195	115,296	816,491	947,361	115,296	1,062,657
	852,660N	390,364	614,727	1,005,091	-	1,005,091	1,666,436	62,857	1,729,293
	853,460N	334,691	654,727	989,418	-	989,418	1,673,306	-	1,673,306
	854,260N	-	-	-	-	-	162,142	-	162,142
	855,060N	573,345	132,655	706,000	-	706,000	1,824,336	-	1,824,336
	855,860N	639,782	474,545	1,114,327	-	1,114,327	1,919,618	-	1,919,618
	856,660N	546,038	1,187,126	1,733,164	113,407	1,846,571	2,060,331	113,407	2,173,738
	857,460N		-	-	-	-	-	-	-
	TOTAL	2,936,599	3,479,832	6,416,431	251,780	6,668,211	10,420,766	314,637	10,735,403
PROBABLE	854,260N	154,000	686,400	840,400	186,154	1,026,554	2,191,367	186,154	2,377,521
POSSIBLE	851,060N	390,461	445,550	836,011	116,538	952,551	2,429,172	116,538	2,545,710
	851,860N	257,782	170,181	427,963	85,055	513,018	2,210,282	85,055	2,295,335
	852,660N	-		-	-	-	959,782	68,571	1,028,353
	853,460N	-	-	-	-	-	1,001,656	-	1,001,656
	854,260N		-	-	-	-	1,082,344		1,082,344
	855,060N	-	-	-	-	-	859,469	-	859,469
	855,860N	-	-	-	-	-	802,747	-	802,747
	856,660N	-	-	-	-		2,293,032	-	2,293,032
	857,460N	458,646	762,673	1,221,319	-	1,221,319	2,357,854	-	2,357,854
	TOTAL	1,106,790	1,378,504	2,485,294	201,593	2,686,887	13,996,338	270,164	14,266,502
	PROVEN	2,936,599	3,479,832	6,416,431	251,780	6,668,211	10,420,766	314,637	10,735,403
	PROBABLE	154,000	686,400	840,400	186,154	1,026,554	2,191,367	186,154	2,377,521
	POSSIBLE	1,106,790	1,378,504	2,485,294	201,593	2,686,887	13,996,338	270,164	14,266,502
	TOTAL 3,900-3,400	4,197,389	5,544,736	9,742,125	639,527	10,381,652	26,608,471	770,955	27,379,426
	TOTAL OUTCROP to 3,900'	12,953,068	12,308,190	25,261,258	1,152,767	26,414,025	62,472,530	1,985,098	64,457,628
	TOTAL 3,900' to 3,400'	4,197,389	5,544,736	9,742,125	639,527	10,381,652	26,608,471	770,955	27,379,426
	TOTAL OUTCROP to 3,400'	17,150,457	17,852,926	35,003,383	1,792,294	36,795,677	89,081,001	2,756,053	91,837,054

SOUTH HILL

GEOLOGICAL RESERVES FROM OUTCROP to 3,900' ABOVE SEA LEVEL

	SECTION	(1) SEAM 2	(2) No. 2 SHALE	(3) SEAM 2+SHALE (1)+(2)	(4) SEAM 4D	(5) SEAM 4L	(6) SEAMS 4D+4L (4)+(5)	(7) No.4 SHALE	(8) 4D+4L+SHALE (6)+(7)	(9) SEAM 5U	(10) SEAM 5L	(11) SEAMS 5U+5L (9)+(10)	(12) No.5 SHALE	(13) 5U+5L+SHALE (11)+(12)	(14) TOTAL ALL SEAMS (3)+(8)+(13)	(15) TOTAL SHALE (2)+(7)+(12)	(16) TOTAL COAL+SHALE (14)+(15)
PROVEN	17,845,460	492,992	-	-	1,610,125	632,541	2,242,666	185,308	2,427,974	1,134,654	925,662	2,060,316	111,407	2,171,723	4,491,974	296,715	4,794,689
	17,846,240	881,071	-	-	2,846,633	2,164,101	5,010,734	421,890	5,432,624	1,568,073	2,067,564	3,635,637	59,736	3,695,373	9,507,642	481,626	9,989,068
	17,847,060	943,307	-	-	6,274,467	1,638,867	5,913,334	582,153	6,495,487	1,612,892	2,038,059	3,651,691	-	3,651,691	9,900,332	582,153	10,690,485
	17,847,860	746,030	-	-	2,769,050	1,597,375	4,366,425	83,077	4,449,502	1,121,881	1,699,772	2,823,653	-	2,823,653	7,916,108	83,077	8,249,185
	TOTAL	2,763,400	-	-	11,500,275	6,032,884	17,533,159	1,272,428	18,805,587	5,239,480	6,331,017	11,551,297	171,143	11,724,440	31,816,056	1,445,571	33,293,427
PROBABLE	17,845,460	64,331	-	-	536,709	207,150	743,859	61,769	805,628	370,288	199,367	687,585	37,082	725,387	1,595,775	99,571	1,695,346
	17,848,260	53,228	-	-	1,508,000	1,423,750	2,931,750	-	2,931,750	686,364	1,692,364	2,578,728	-	2,578,728	5,563,706	-	5,563,706
	TOTAL	117,559	-	-	2,044,709	1,630,900	3,675,609	61,769	3,737,378	1,264,582	2,001,731	3,266,313	37,082	3,304,115	7,059,481	99,571	7,159,052
POSSIBLE	17,846,660	-	-	-	348,400	79,100	427,500	-	427,500	-	-	1,408,900	-	1,408,900	2,836,400	-	2,836,400
	17,846,460	-	-	-	415,569	81,467	496,967	70,769	567,736	812,900	127,964	238,873	-	238,873	735,840	70,769	806,609
	17,846,260	26,205	-	-	156,600	95,331	251,335	29,231	280,566	151,272	169,508	520,872	153,099	673,971	798,410	182,330	980,740
	17,847,060	-	-	-	-	-	-	-	-	272,250	386,909	659,159	-	659,159	659,159	-	659,159
	17,847,860	110,551	-	-	364,000	234,975	598,975	-	598,975	175,187	294,982	465,164	-	465,164	1,176,690	-	1,174,690
	17,848,260	231,339	-	-	150,500	268,000	625,500	-	625,500	-	-	-	-	-	856,839	-	856,839
	17,848,660	108,425	-	-	365,937	267,500	628,437	82,994	711,431	-	-	1,717,322	-	1,717,322	3,926,184	82,994	3,997,178
	TOTAL	476,520	-	-	2,002,337	1,026,575	3,028,912	182,994	3,211,906	709,653	1,179,455	6,550,330	153,099	6,703,429	8,055,762	336,093	8,391,855
	PROVEN	2,763,400	-	-	11,500,275	6,032,884	17,533,159	1,272,428	18,805,587	5,239,480	6,331,017	11,551,297	171,143	11,724,440	31,816,056	1,445,571	33,293,427
	PROBABLE	117,559	-	-	2,044,709	1,630,900	3,675,609	61,769	3,737,378	1,264,582	2,001,731	3,266,313	37,082	3,304,115	7,059,481	99,571	7,159,052
	POSSIBLE	476,520	-	-	2,002,337	1,026,575	3,028,912	182,994	3,211,906	709,653	1,179,455	6,550,330	153,099	6,703,429	8,055,762	336,093	8,391,855
	TOTAL 3,900	3,357,479	-	-	15,547,321	8,690,359	24,237,680	1,517,191	25,754,871	7,213,715	9,493,003	19,367,940	361,044	19,731,984	46,963,099	1,881,235	48,844,334

SOUTH HILL

GEOLOGICAL RESERVES FROM 3,900' to 3,600' ABOVE SEA LEVEL

	(1) SECTION	(1) SEAM 2	(2) No. 2 SHALE	(3) SEAM 2 + SHALE (1)+(2)	(4) SEAM 4U	(5) SEAM 4L	(6) SEAMS 4U+4L (4)+(5)	(7) No. 4 SHALE	(8) 4U+4L+SHALE (6)+(7)	(9) SEAM 5U	(10) SEAM 5L	(11) SEAMS 5U+5L (9)+(10)	(12) No. 5 SHALE	(13) 5U+5L+SHALE (11)+(12)	(14) TOTAL ALL SEAMS (1)+(6)+(11)	(15) TOTAL SHALE (2)+(7)+(12)	(16) TOTAL COAL+SHALE (14)+(15)
PROVEN	17,946,260	-	-	-	357,533	159,115	516,668	28,857	545,525	491,211	404,909	726,165	75,604	801,769	1,242,834	104,461	1,347,295
	17,947,060	58,961	-	.	312,000	287,267	599,267	115,296	714,563	68,072	107,787	175,855	-	175,855	834,082	115,296	949,379
	17,841,960	-	-	-	-	-	-	-	-	360,700	643,800	812,100	-	812,100	812,100	-	812,100
	TOTAL	58,961	-	.	669,533	446,402	1,115,935	144,152	1,270,088	557,610	1,156,491	1,714,101	75,604	1,789,705	2,882,997	229,757	3,110,754
PROBABLE	17,848,260	.	-	-	-	-	-	-	-	44,318	89,818	134,136	-	134,136	134,136	-	134,136
	TOTAL	-	-	-	-	-	-	-		44,318	89,818	134,136	-	134,136	134,136	-	134,136
POSSIBLE	17,946,260	94,992	-	-	346,000	227,500	473,500	24,000	497,500	-	-	-	-		568,492	24,000	592,492
	17,947,060	140,850	-	-	-	-	.	-		-	-	-	-	-	140,850	-	140,850
	17,947,860	110,551	-	-	552,000	234,000	786,000	-	786,000	33,000	55,500	88,500	-	88,500	985,051	-	985,051
	17,948,260	124,882	-	-	383,500	329,417	712,917	-	712,917	132,954	189,091	322,045	-	322,045	1,159,844	-	1,159,844
	17,848,660	72,709	-	-	206,250	152,500	358,750	47,760	406,550	-	-	301,118	-	301,118	732,576	47,760	780,336
	TOTAL	541,983	-	.	1,487,750	843,417	2,331,167	71,760	2,402,927	165,954	244,591	711,663	-	711,663	3,586,813	71,760	3,658,573
	PROVEN	58,961	-	-	669,533	446,402	1,115,935	154,153	1,270,088	557,610	1,156,491	1,714,101	75,604	1,789,705	2,868,997	229,757	3,110,754
	PROBABLE	-	-	-	-	-	-	-	-	44,318	89,818	134,136	-	134,136	134,136	-	134,136
	POSSIBLE	541,983	-	-	1,487,750	843,417	2,331,167	71,760	2,402,927	165,954	244,591	711,663	-	711,663	3,586,813	71,760	3,658,573
	TOTAL 3900'-3600'	602,944	-	-	2,157,283	1,289,819	3,447,102	225,913	3,673,015	767,882	1,490,900	2,559,900	75,604	2,635,504	6,609,946	301,517	6,911,463

TOTAL GEOLOGICAL RESERVES

CATEGORY	(1) SEAM 2	(2) NO. 2 SHALE	(3) SEAM 2 + SHALE (1) + (2)	(4) SEAM 4U	(5) SEAM 4L	(6) SEAMS 4U + 4L (4) + (5)	(7) NO. 4 SHALE	(8) 4U + 4L + SHALE (6) + (7)	(9) SEAM 5U	(10) SEAM 5L	(11) SEAMS 5U + 5L (9) + (10)	(12) NO. 5 SHALE	(13) 5U + 5L + SHALE (11) + (12)	(14) TOTAL ALL SEAMS (1) + (6) + (11)	(15) TOTAL SHALE (2) + (7) + (12)	(16) TOTAL COAL + SHALE (14) + (15)
PROVEN TO 3,400'	9,209,879	684,903	9,894,782	17,054,763	10,349,186	27,403,946	210,285	27,614,231	15,150,737	14,568,968	29,719,705	1,454,547	31,174,252	66,333,529	2,299,735	68,633,264
PROBABLE TO 3,400	258,945	-	258,945	2,477,383	1,126,400	3,603,783	-	3,603,783	628,182	1,496,545	2,124,727	186,154	2,310,881	5,987,455	186,154	6,173,609
POSSIBLE TO 3,400'	3,594,126	-	3,594,126	7,482,976	2,523,984	10,006,960	66,571	10,073,531	1,371,510	1,787,433	3,158,943	208,593	3,360,524	16,760,917	270,164	17,030,181
TOTAL TO 3,400'	13,062,950	684,903	13,747,853	27,014,119	13,999,570	41,014,689	276,856	41,291,545	17,150,437	17,852,926	35,003,363	1,792,294	36,795,657	89,081,993	2,756,053	91,837,054
PROVEN TO 3,600'	2,972,161	-	-	11,169,080	6,479,286	18,648,376	1,426,581	20,075,675	5,797,090	7,466,308	13,265,398	248,747	13,514,145	34,736,053	1,675,128	36,411,181
PROBABLE TO 3,600'	137,559	-		2,044,709	1,630,900	3,675,609	61,769	3,737,378	1,308,900	2,091,549	3,400,449	31,802	3,438,251	7,191,617	93,571	7,293,188
POSSIBLE TO 3,600'	1,020,103		-	3,490,087	1,869,992	5,360,079	234,754	5,594,833	870,607	4,424,066	5,263,993	159,099	5,415,092	11,642,175	407,853	12,050,429
TOTAL TO 3,600'	3,960,423		-	17,704,604	9,980,178	27,684,753	1,743,104	29,427,886	7,976,597	10,983,903	21,927,843	439,640	22,367,490	53,571,345	2,182,152	55,755,797

RIO TINTO CANADIAN EXPLORATION LIMITED

ROTARY DRILL RECORD

Hole No.: S.C.C. 74-01 Property: Sage Creek Coal

Location: 17,848,128N 583,295E Elevation: 5206

Contractor: Becker Drilling Ltd. Hole Size: 5-1/8" & 5-1/4"

Rig No.: 4520

Date Commenced Drilling: Sept. 8, 1974 (6:00 p.m.)

Date Finished Drilling: Sept. 11, 1974 (5:00 p.m.)

Date Hole Completed: Sept. 12, 1974

Logged By: Jim Baker Date: Sept. 12, 1974

Probed By: Roke Oil Enterprises Date: Sept. 12, 1974

Total Depth Drillers: 800' Depth of Overburden: 15'

Total Depth Logger: 795' Water Level: @ 270' or Elev. 4936'

Bit Record

No.	Size	Make and Serial No.	R.P.M.	On	Off	Footage	Drilling Time

Surface Casing: 15'
Total Drilling Time: 84 hrs.
Total Down Time: -
Total Footage Chargeable: 800'
Total Hourly Contact: 4½ hrs.

Standby Time for Logging: 5½ hrs.
Other Standby Time: 10-1/4 hrs.
Total Chargeable Standby Time: 15-3/4 hrs
Actual Moving Time Between Holes: 1 hr.
Chargeable Moving Time " " : -

Remarks:- Lost circulation @ 149'.
Changed from conventional to air.
Aquifer encountered-water level @ 270'
Seam #5 faulted out @ 565' - ∿ 180' displaced.

Quantity of Mud Used:
18(50#) Super Gel
7(40#) Kwik Seal(fine)
7(50#) Kwik Seal(Med)

Probe Report:

550 - 0 Sidewall density - Open hole.
550 - 0 Caliper - Open hole.
795 - 0 Gamma Ray Neutron Log - Logged thru double walled drill pipe.

Coal Horizons

Coal Horizon	Drillers Picks	Interval	Log Picks	Interval
Seam #2	68 - 82	14	67 - 79	13
Seam #4	365 - 446	81	366 - 442	76
Seam #5	Nil	-	Nil	-

INTERVAL	UNIT THICKNESS	DESCRIPTION
0' - 65'	65'	Shale - M.-dk. gy., argil., coal frags. slt.st.str. from 25' - 45' -buff - lt. gy. -Fe. Stn. -minor v. f. gr. ss
65' - 82'	17'	Coal - Black, soft - hard, Sh. present #2 seam
82' - 115'	33'	Silststone - Lt. - med. gy., argil. abd. micro muscovite Fe. st. - possible frac. zone minor f. gr. ss.
115' - 175'	60'	Sandstone - v. f. gr. - m. gr. ss. chert & qtz. pred. sub angular - angular silica matrix abd. micro muscovite minor calcite. Note: 140' - 145' Fe. st. (frac. zone) @ 149' - lost circulation - converted to air drilling - recovered samples again @ 165'
175' - 225'	50'	Siltstone - buff - lt. gy. - argil., - abd. micro muscovite - abd. silt. & argil. nature - tr. calcite & Fe. st.
225' - 300'	75'	Sandstone - v. f. gr. - f. gr. - lt. - med. gy. - chert & qtz. gr. - silty - silica matrix - sub angular - rounded - mainly good sorting - 280' - 300' Fe. st.
300' - 365'	65'	Siltstone - med. - dk. gy. - blocky, abd. micro muscovite - argil., tr. marcasite - shale str. @ 305' - 315'
365' - 446'	79'	Coal - black, shiny, most hard - conchoidal frac. - abd. carb. sltst. - marcasite veinlets present
446' - 530'	84'	Shale - m. - lt. gy. - somewhat silty - abd. micro muscovite - tr. marcasite - coal str. 525' - 530'
530' - 565'	35'	Sandstone - v.f. gr. lt. - m. gy. - qtz. & chert gr. - silica cement - tr. coal - silty - argil.
565'		Probable Fault
565' - 800	235'	Shale - Lt. - med. gy. - tr. marcasite - abd. micro marcasite - abd. calcite throughout - sltst. stringer 575' - 580' - tr. f. gr. ss. in upper part of interval. Fernie Gp.
800		T.D.

RIO TINTO CANADIAN EXPLORATION LIMITED

ROTARY DRILL RECORD

Hole No.: S.C.C. 74-03

Property: Sage Creek Coal

Location: 17,847,862N
582,808E

Elevation: 5224'

Contractor: Becker Drilling Ltd.

Hole Size: 5 1/8" - 5 7/8"

Rig No.: 4515

Date Commenced Drilling: Sept. 18, 1974

Date Finished Drilling: Sept. 19, 1974

Date Hole Completed: Sept. 20, 1974

Logged By: O. Cullingham, J.Baker

Date: Sept. 20, 1974

Probed By: Roke Oil Enterprises

Date: Sept 20, 1974

Total Depth Drillers: 413'

Depth of Overburden: 5'

Total Depth Logger: 410'

Water Level: 49' or elev. 5175'

Bit Record

No.	Size	Make and Serial No.	R.P.M.	On	Off	Footage	Drilling Time

Surface Casing: 7'
Total Drilling Time: 40 hrs.
Total Down Time: ———
Total Footage Chargeable: 413
Total Hourly Contact: 1 hr.

Standby Time for Logging: 1/2 hr.
Other Standby Time: 4 hrs.
Total Chargeable Standby Time: 4 1/2 hr.
Actual Moving Time Between Holes: 3 hrs.
Chargeable Moving Time " " : 2 hrs.

Remarks:-

Possible thrust fault @ 204' - 22' of stratigraphy repeated.

Probe Report:

410 - 0	Gamma/Neutron	-	Open Hole
410 - 0	Sidewall Density	-	Open Hole
410 - 0	Caliper	-	Open Hole

Coal Horizons

Coal Horizon	Drillers Picks		Log Picks	
Seam # 4	80'-142'	62'	70'-140'	70'
Seam # 5	342'-390'	48'	332'-390'	58'

INTERVAL	UNIT THICKNESS	DESCRIPTION
0 - 5	<5	OVERBURDEN. Broken rock and fill.
5 - 55	50	SANDSTONE - m. gy bn. wthrg., (Fe stn near surface) - m. gy., m-c gr. with some interbeds of f.g. - chert & qtz gr. - p. sort., r-A gr. - blocky, hd.
55 - 108	53	SHALE - dk. gy., carb., some coal bands & thin seams - in part sl. slty.
108 - 126	18	COAL HORIZON #2 - 108 - 110 -Coal with black shale -lrg. blocky frags. - 110 - 118 -Coal finely grnd., dull lustre - 118 - 126 -Coal ptcls intermixed with drilling mud & quikseal. (Possibly caving from above)
126 - 145	19	SHALE - m. to m. dk gy., carb in upper part of unit. - grading to sltst. downwards.
145 - 205	60	SANDSTONE - m. gy., some limn Fe stn. - m to c gr. with v.c. gr lenses - chert 7 qtz grs. - p. sort., a-A grns. - sil cmt, ld., blocky chips - minor white calcite cmt.
205 - 225	20	SILTSTONE - m. gy., slt to v.f.gr. ss. - argillaceous - thin coaly shale to shaly coal bands near top of unit - sharp contact with above
225 - 280	55	SANDSTONE - m. gy., some limn. stn. - gradational from above to c. gr. - p. sort., a-A., - qtz & chert gr. 260 - 265 Siltstone - abrupt change to sltst & back to c. gr. ss. - traces of coalified woody, remn. within ss.

INTERVAL	UNIT THICKNESS	DESCRIPTION
280 - 305	25	SILTSTONE - m. gy., - well bdd., with layers of carbonaceous material - minor arg. material - minor Fe stn - grades into underlying shale
305 - 339	34	SHALE - m. to dk. gy., slty grading downwards into carb shale. - coaly st. & shaly coal buds nr base of unit
339 - 394	55	COAL HORIZON 4 - some shaly material - finely grnd 375 - 377 - intermixed with black shale,
394 - 415	21	SHALE - m. gy to m dk gy., - carb in part, some coaly Sh to shaly coal bands and stringers
415 - 448	33	SILTSTONE - m. gy., blocky, - arg in part - in part v. sl. calc. 445 - 448 - coal bands intermixed with shale & f. gr. ss. frags.
448 - 470	22	SANDSTONE - m. gy., blocky - fine gr. with lenses to slt. - minor coal ptcls. (possibly from above)
470 - 530	60	SILTSTONE - m. to m. lt gy., - blocky, argill. to aren. - v. sl. micro-mica. - Gradational to shale downwards. - 515 - 530 - shale slty to carb.
530 - 577	47	COAL HORIZON #5 - coal with occasional interbes of shale.
577 - 604	27	SANDSTONE - m to m lt gy - mainly qtz, / minor chert, - r-a gr., - moderately to well sorted - minor calcite veinlets. - BASAL SANDSTONE
604		T.D.

RIO TINTO CANADIAN EXPLORATION LIMITED

ROTARY DRILL RECORD

Hole No.: S.C.C. 74-05

Property: Sage Creek Coal

Location: 17,847,072N
581,996E

Elevation: 5365'

Contractor: Becker Drills Ltd.

Hole Size: 5 1/8"

Rig No.: 4515

Date Commenced Drilling: September 16, 1974

Date Finished Drilling: September 17, 1974

Date Hole Completed: September 18, 1974

Logged By: J. Baker

Date: September 18, 1974

Probed By: Roke Oil Enterprises

Date: September 18, 1974

Total Depth Drillers: 186'

Depth of Overburden: 5'

Total Depth Logger: 183'

Water Level: 12' or elev. 5353

Bit Record

No.	Size	Make and Serial No.	R.P.M.	On	Off	Footage	Drilling Time

Surface Casing: 6'
Total Drilling Time: 20 hrs.
Total Down Time: ———
Total Footage Chargeable: 185
Total Hourly Contact: ———

Standby Time for Logging: 1 hr.
Other Standby Time: 3 hrs.
Total Chargeable Standby Time:
Actual Moving Time Between Holes: 2 hrs.
Chargeable Moving Time " " : 1 hr.

Remarks:-

Fault below Seam 4U with apparent displacement of 150'.

Probe Report:

183 - 0	Gamma/Neutron	- Open Hole
183 - 0	Sidewall Density	- Open Hole
183 - 0	Caliper	- Open Hole
182 - 38	E-Log	- Open Hole

Coal Horizons

Coal Horizon	Drillers Picks		Log Picks	
Seam #4 (upper)	61' - 77'	16	55 - 80	25
Seam #5	99' - 151'	52'	97 - 147	50

INTERVAL	UNIT THICKNESS	DESCRIPTION
0' - 61'	61'	SHALE - lt. gy., micro-mica (Muscavite) - silty in part - Fe. st. throughout - large frags. @ 50' possible frac. zone - tr. coal throughout
61' - 77'	16'	COAL - mainly fairly hard, shiney, - black - traces of weathered frags, of ss. & sh. (Fe. st.) - abd. shale present - tr. marcasite
77' - 99'	22'	SHALE - med. dark gy. - abd. coal present - tr. marcasite
99' - 151'	52'	COAL - black shiney - m. soft - 137' - 151' grades to v. shaley coal - tr. marcasite
151' - 165'	14'	SANDSTONE - buff (Fe. st. present - hematite) - f. - m. gr. - qtz. & chert (qtz. predom.) - silica cement - sub angular - well sorted - tr. shale - fair porosity

RIO TINTO CANADIAN EXPLORATION LIMITED

ROTARY DRILL RECORD

Hole No.: S.C.C. 74 - 06

Property: Sage Creek Coal

Location: 17,847,054N
583,602E

Elevation: 5147' asl

Contractor: Becker Drills Ltd.

Hole Size: 5-1/8" - 5-5/8"

Rig No.: 4520

Date Commenced Drilling: September 4, 1974

Date Finished Drilling: September 8, 1974

Date Hole Completed: September 9, 1974
September 15, 1974

Logged By: D. Tait

Date: September 9, 1974

Probed By: Roke Oil Enterprises

Date: September 8, 1974
September 15, 1974

Total Depth Drillers: 642'

Depth of Overburden: 3'

Total Depth Logger: 636'

Water Level: 26' or elev. 5121

Bit Record

No.	Size	Make and Serial No.	R.P.M.	On	Off	Footage	Drilling Time

Surface Casing: 12' of 8" casing
Total Drilling Time: 77 hrs.
Total Down Time: 23½ hrs.
Total Footage Chargeable: 642'
Total Hourly Contact: 5½ hrs.

Standby Time for Logging: 1½ hrs.
Other Standby Time: 2 "
Total Chargeable Standby Time: 6½ "
Actual Moving Time Between Holes: 3½ hrs
Chargeable Moving Time " " : 2½ "

Remarks:-
Moved back on hole - stripped mud cake and relogged with Density.
Possible Fault @ 95'-10[illegible]' displacing 85'of strata

Quantity of Mud Used:
11 bags #50 Supergel
2 bags #2 Poly-sec

Probe Report:
636 - 0 .....Gamma/Neutron.....Open Hole
636 - 0 .....Sidewall Density.....Open Hole
636 - 0 .....Caliper.....Open Hole
552 - 0 .....Gamma/Resistance ....Open Hole
521 - 26 .....E-Log.....Open Hole

Coal Horizons

Coal Horizon	Drillers Picks		Log Picks	
Seam 2	-	-	-	-
Seam 4 (U)	325 - 375	50	323 - 350	27)
Seam 4 (L)			354 - 365	11) 49
			369 - 372	3)
Seam 5	520 - 557	37	514 - 554	40

INTERVAL	UNIT THICKNESS	DESCRIPTION
0 - 110'	105'	SANDSTONE - m. gy., silty to m. gr., - chert & qtz., FeO staining to 50' - chert gr. slightly larger than qtz. gr. - sub angular 104 - 106 - siltstone interbedded / ss. 106 - 110 - sandstone
110 - 115'	5'	SILTSTONE - very silty, dirty gray - porous - coke-like
115 - 185'	70'	SANDSTONE - m. - c. grained - chert - silica, gray ss. poorly sorted 175 - 180 - c. grained conglomeritic
185 - 210'	25'	SILTSTONE & SHALE - medium to dark gray shale carboniferous with thin coal veinlets
210 - 275'	65'	SANDSTONE - c. grained, lt. gray - buff colored - conglomeritic in part 220 - 225 - ss. - shale/coal & calcareous particles
275 - 325'	50'	SILTSTONE & SHALE - 315 - 320 - shale/thin coal seams
325 - 375'	50'	COAL - Seam 4 - interbedded shale 325 - 340 - Coal & shale seams 340 - 350 - Coal 350 - 362 - Coal / seam of shale 362 - 364 - Coal 364 - 375 - Coal / shale & siltstone
375 - 495'	120'	SILTSTONE & SHALE & coal seams - thin coal seams in carbonaceous shales 375 - 380 - shale - coal seams 380 - 430 - siltstone & carb. shale pyrite or marcasite veinlets 430 - 440 - shale - carb. & coal seams 440 - 445 - coal mixed / carb. shale
495 - 515	20	SANDSTONE - m. grained - m. lt. gray - qtz. & chert
515 - 520	5	SHALE - dark gray, carboniferous argillite with coal seams - in part micaceous, siltstone & ss. interbeds
520 - 558	38	COAL - Seam 5 520-550 - coal/bands of dk. shales 550-558 - shiny black coal 556-558 - coal intermixed/Fe. stained ss. & dk. gray shale

INTERVAL	UNIT THICKNESS	DESCRIPTION
558 - 630	72	SANDSTONE - clean, m. - c. grained, lt. - m. gray sandstone, considerable qtz. & calcareous material - coal particles from above
630 - 640	10	SHALE - interbedded with c. grained ss. - dirty gray or silty in appearance - some coal & carbonaceous material cavings from above

RIO TINTO CANADIAN EXPLORATION LIMITED

ROTARY DRILL RECORD

Hole No.: 74-07

Property: Sage Creek Coal

Location: 17,847,062N
585,205E

Elevation: 4918

Contractor: Becker Drilling Ltd.

Hole Size: 5-1/8" - 5-7/8"

Rig No.: 45-20

Date Commenced Drilling: September 15, 1974

Date Finished Drilling: September 20, 1974

Date Hole Completed: September 20, 1974

Logged By: O. Cullingham
D. Tate

Date: September 20, 1974

Probed By: Roke Oil Enterprises Ltd.

Date: September 20, 1974

Total Depth Drillers: 927

Depth of Overburden: 5'

Total Depth Logger: 926

Water Level: 58' on elev.4860

Bit Record

No.	Size	Make and Serial No.	R.P.M.	On	Off	Footage	Drilling Time

Surface Casing: 6'
Total Drilling Time: 106 hrs.
Total Down Time: 2 hrs.
Total Footage Chargeable: 927'
Total Hourly Contact: 13½ hrs.

Standby Time for Logging: 3½ hrs.
Other Standby Time: 10 hrs.
Total Chargeable Standby Time: 13½ hrs.
Actual Moving Time Between Holes: 1 "
Chargeable Moving Time " " : -

Remarks:- Hole commenced with muds and switched to air.
Horizon #1 - thin coal bands in 36' horizon.

Probe Report:

924 - 0	Gamma/Neutron	- Thru double wall pipe.
921 - 0	Sidewall Density	- Open hole.
921 - 0	Caliper	- Open hole.
920 - 150	E-Log	- Open hole.

Coal Horizons

Coal Horizon	Drillers Picks		Log Picks	
Horizon #1	98 - 123'	25'	106 - 132'	26'
Seam #2	268 - 298'	30'	264 - 270' (6') + 271 - 283' (12')	19'
Seam #4	535 - 621'	86'	529 - 585 (56') + 591 - 614 (23')	85'
Seam #5	877 - 911'	34'	872 - 882 (10') + 887 - 108 (21')	36'

INTERVAL	UNIT THICKNESS	DESCRIPTION
0 - 40'	40'	CONGLOMERATE - crs. grained - buff - weathered - cadomin Conglo.
40 - 98'	58'	SANDSTONE - crs. grained - qtz. rich - Fe. st. - p. sorted - chert present
98 - 123'	25'	COAL - shale & sltst. present
123 - 160'	43'	SILTSTONE - grey to buff - fn. grained - p. sorted - limonite st.
160 - 235'	75'	SANDSTONE - fn.-crs. grained - limonite alteration - buff colored
220 - 268'	48'	SHALE - dk. grey micro-micaceous - tr. coal - tr. ss.
268 - 298'	30'	COAL - dirty looking - dk. grey - black
298 - 505'	207'	SANDSTONE - m.-crs. grained - m. grey chert & qtz. intermixed - m-dk. gray - p. sorted - 345 - 349 - coal - 369 - 371 - coal - 405 - 425 - shale
505 - 535'	30'	SHALE AND SILTSTONE - dk. grey - slt. (argil.)
535 - 621'	86'	COAL
621 - 877'	256'	SHALE AND SILTSONE - dk. grey shale - sltst. med. grey
877 - 911'	34'	COAL
911 - 920'	9'	SANDSTONE - Basal

RIO TINTO CANADIAN EXPLORATION LIMITED

ROTARY DRILL RECORD

Hole No.: 74 - 08

Property: Sage Creek Coal

Location: 17,846,197N
581,172E

Elevation: 5505'

Contractor: Becker Drilling Ltd.

Hole Size: 5 1/8"- 4 7/8"

Rig No.: 4515

Date Commenced Drilling: September 14, 1974

Date Finished Drilling: September 23, 1974

Date Hole Completed: September 23, 1974

Logged By: Cullingham & Baker

Date: September 16 to 20, 1974

Probed By: Roke Oil Enterprises Ltd.

Date: September 16, 1974
September 20, 1974

Total Depth Drillers: 416

Depth of Overburden: 12'

Total Depth Logger: 415

Water Level: 21' or elev.5484

Bit Record

No.	Size	Make and Serial No.	R.P.M.	On	Off	Footage	Drilling Time

Surface Casing: 6'
Total Drilling Time: 66 hrs.
Total Down Time: ——
Total Footage Chargeable: 416'
Total Hourly Contact: 12 hrs.

Standby Time for Logging: 3 hrs.
Other Standby Time: 4½ hrs
Total Chargeable Standby Time: 7½ hrs.
Actual Moving Time Between Holes: 5 hrs.
Chargeable Moving Time " " : 4 hrs.

Remarks:-
Finished Drilling September 16.
Moved back onto hole September 22 and deepened hole
Hole drilled Fernie Gp. - Collared in the basal SS.

Probe Report:

414 - 0	Gamma/Neutron	-	Thru Double Walled Pipe
304 - 0	Sidewall Density	-	Open Hole
304 - 0	Caliper	-	Open Hole

Coal Horizons

Coal Horizon	Drillers Picks		Log Picks	

Hole 74-08

INTERVAL	UNIT THICKNESS	DESCRIPTION
0 - 45'	45'	Siltstone, Shale & Sandstone SS - m. dk. gy., chert & qtz, silica cement Sh - m. dk. gy., argil abundant Fe.st. present in this interval large frags of weathered particles also
45'- 90'	45'	Sandstone - m. dk. gy. - m. c. gr., chert & qtz. - argil matrix, poorly sorted - fair porosity - disaggragated - blocky frags., abd. Fest suggested frac. zone. - tr. coal and shale - silty sh. stringer @ 60'-70'
90' - 250'	160'	Shale grading to Slt. st. periodically Sh. - m. gy.- dk. gy. - blocky - slightly silty in most part - rounded frags - micro micacous Slt. st. - blocky frags in part minor Fe. st. throughout SS - v.f. - f. gr. SS (around 205' and deeper) - chert & qtz. - Fe. st. present
250' - 370'	120'	Sandstone - v. f. gr. - m. gy., chert & qtz. - silica matrix - well sorted - sub rounded - abd. sh. grading to silty - abd. slt. st. present - qtz. veinlets present - micro muscavite present in slt. st. & sh. - Fe. st. present in blocky frags. - tr. calcite
370' - 415'	45'	Shale - m. dk. gy. - micro muscavite - v. argil & dirty - grading to silty - stringers of ss - 390 - 395 - 400 - 405

RIO TINTO CANADIAN EXPLORATION LIMITED

ROTARY DRILL RECORD

Hole No.: 74-09

Property: Sage Creek Coal

Location: 17,846,624N
582,601E

Elevation: 5289'

Contractor: Becker Drilling Ltd.

Hole Size: 5 1/8"-5 5/8 "

Rig No.: 4518

Date Commenced Drilling: October 21, 1974

Date Finished Drilling: October 23, 1974

Date Hole Completed: October 25, 1974

Logged By: Richard S. Blakeney

Date: Oct. 25, 1974

Probed By: Roke Oil Enterprises

Date: Oct. 23, 1974

Total Depth Drillers: 601

Depth of Overburden: 5

Total Depth Logger: 598

Water Level: 7 feet or 5282'

Bit Record

No.	Size	Make and Serial No.	R.P.M.	On	Off	Footage	Drilling Time

Surface Casing: 5
Total Drilling Time: 60 hrs.
Total Down Time: ——
Total Footage Chargeable: 601
Total Hourly Contact: ——

Standby Time for Logging: 3 hrs.
Other Standby Time: ——
Total Chargeable Standby Time: 3 hrs.
Actual Moving Time Between Holes: 6 hrs.
Chargeable Moving Time " " : 4 hrs.

Remarks:-

Probe Report:

596 - 0	-	Gamma/Neutron	-	Open Hole
596 - 0	-	Sidewall Density	-	Open Hole
596 - 0	-	Caliper	-	Open Hole
598 - 45	-	E - Log	-	Open Hole

Coal Horizons

Coal Horizon	Drillers Picks	Interval	Log Picks	Interval
Seam #4 Upper	194-237	43	195-237	42'
Seam #4 Lower	243-280	37	242-265	21'
Seam #4 Lower (lower split)			273-280	7'
Seam #5	Missed	——	506-538	32'

74-09

INTERVAL	UNIT THICKNESS	DESCRIPTION
0 - 5	5	Overburden
5 - 145	140	Sandstone - medium grey - mainly coarse grained - angular to subangular - poorly sorted - chert 5% - siliceous cement - some limonite staining - minor interbeds of siltstone and fine sandstone.
145 - 194	49	Shale - dark grey - silty - possibly slightly micaceous - some thin coaly laminac
194 - 237	43	Coal - Seam 4 Upper - mainly blocky - in part very fine - in part shaly - with some thin shale stringers
237 - 243	6	Shale and sandstone interbedded Shale - dark grey - coaly - silty Sandstone - medium grey - fine grained - well sorted - sub-angular - siliceous cement
243 - 280	37	Coal - Seam 4 Lower - very fine near top - becoming more shaly basally - minor interbeds of coaly shale
280 - 303	23	Siltstone - dark grey - siliceous - hard - some shale at top
303 - 360	57	Sandstone - medium grey - siliceous cement - moderate sorting - slightly calcareous basally - very fine to fine grained - sub-angular to sub-rounded - siltstone band from 325 to 340
360 - 413	53	Shale - dark grey - silty - some plant fragments - coaly - thin coal stringers

74-09

INTERVAL	UNIT THICKNESS	DESCRIPTION
413 - 420	7	Sandstone - light to medium grey - very fine grained - siliceous cement - sub-angular - moderately sorted
420 - 500	80	Siltstone - medium grey - hard - slightly shaly basally - slightly coaly basally - slightly micaceous basally
500 - 540	40	Shale - dark grey - coaly - finely micaceous - thin coal stringers - Seam 5 included in this interval and missed by drillers
540 - 552	12	Sandstone - medium grey - medium grained - well sorted - hard - sub-rounded - siliceous cement
552 - 601	48	Sandstone, Siltstone and Shale interbedded Sandstone - very fine grained - micaceous - well sorted - sub-rounded - dark grey - siliceous cement Siltstone - medium grey - argillaceous - shaly - slightly micaceous Shale - dark grey - silty - micaceous
601		BOTTOM OF HOLE

RIO TINTO CANADIAN EXPLORATION LIMITED

ROTARY DRILL RECORD

Hole No.: 74-10A

Property: Sage Creek Coal

Location: 17,846,244N
584,408E

Elevation: 4966

Contractor: Becker Drilling Ltd.

Hole Size: 4 7/8" - 5 5/8"

Rig No.: 45-20

Date Commenced Drilling: Sept. 29, 1974

Date Finished Drilling: Oct. 4, 1974

Date Hole Completed: Oct. 4, 1974

Logged By: Owen Cullingham, Jim Baker

Date: Oct. 4, 1974

Probed By: Roke Oil Enterprises Ltd.

Date: Oct. 4, 1974

Total Depth Drillers: 838'

Depth of Overburden: 12'

Total Depth Logger: 836'

Water Level: 140' or elev. 4826'

Bit Record

No.	Size	Make and Serial No.	R.P.M.	On	Off	Footage	Drilling Time

Surface Casing: 22
Total Drilling Time: 116 hrs.
Total Down Time: ———
Total Footage Chargeable: 838'
Total Hourly Contact: 25 hrs.

Standby Time for Logging: 5 1/2 hrs.
Other Standby Time: ———
Total Chargeable Standby Time: 5 ½ hrs.
Actual Moving Time Between Holes: 5½ hrs.
Chargeable Moving Time " " : 4½ hrs.

Remarks:- Bad caving in upper part of hole. Hole skidled and redrilled
Approx. 130' of strata displaced by probable fault @ 710'.

Probe Report:

834 - 0	- Gamma/Neutron	- Thru Double Wall Pipe
552 - 0	- Sidewall Density	- Open Hole
552 - 0	- Caliper	- Open Hole
600 - 132	- E-Log	- Open Hole

Coal Horizons

Coal Horizon	Drillers Picks		Log Picks		
Seam #2	260' - 277'	17'	257 - 261 265 - 275	4) 10)	18'
Seam #4	470' - 544'	74'	475 - 513 519 - 532 535 - 537	38) 13) 2)	62'
Seam #5	FAULTED OUT!				

INTERVAL	UNIT THICKNESS	DESCRIPTION
0 - 80	80'	Sandstone - crs. gr. - wh - lt. gy. - qtz & chert (more qtz) - silica cmt. - p. sort - abd. Fest present - abd. large chert frags. - angular
80 - 260	80'	SS & SHALE Sandstone - fn. - m gr. - angular - buff - lt. gy. - chert & qtz. - sub angular - sub rounded - EXTREME FE ST throughout (weathered) - grading to silty - abd. marcasite & calcite Shale - m - dk. gy. - Tr. marcasite - abd. micro muscovite - grades to silty
260 - 277	17'	COAL - tr. marcasite - shale str. near top & bottom
277 - 470	93'	SANDSTONE - m - crs. gr., lt. m. gy. - chert & qtz. - silica cmt. - p. sorted, sub rounded. - abd. v. fn. gr. ss. - 390' -- 410' sh. bands - weathered (Fe st present)
470 - 544	74'	COAL - sh. band @ 518' - 524 separates upper & lower bench on Seam #4
544 - 580	36'	SHALE - m - dk. gy. - v. sl. carb. - silty, blocky
580 - 610	30'	SANDSTONE - m - br. gy. - f. gr. - w. sorted - silica cmt. - w. rounded
610 - 838 (TD)	228'	SHALE, SS, SLT ST - sl. abd. micro muscovite - m. gy., arg., blocky. - @ 710-720 appears wthrd., incl. frags. possible fault - below 710 Fernie Gp.

ROTARY DRILL RECORD

Hole No.: 74-11 Core Hole

Property: Sage Creek Coal

Location: 17,846,287N
585,224E

Elevation: 4809'

Contractor: Becker Drilling Ltd.

Hole Size: 6-3/4"

Rig No.: 4518

Date Commenced Drilling: October 10, 1974

Date Finished Drilling: October 20, 1974

Date Hole Completed: October 22, 1974

Logged By: Richard S. Blakeney

Date: October 22, 1974

Probed By: Roke Oil Enterprises

Date: October 21, 1974

Total Depth Drillers: 830'

Depth of Overburden: 76'

Total Depth Logger: 826'

Water Level: 39' or elev. 4770'

Bit Record

No.	Size	Make and Serial No.	R.P.M.	On	Off	Footage	Drilling Time

Surface Casing: 20'
Total Drilling Time: 224 hrs.
Total Down Time: 28 hrs.
Total Footage Chargeable: -
Total Hourly Contact: 219.5

Standby Time for Logging: 2 hrs.
Other Standby Time: -
Total Chargeable Standby Time: 2 hrs.
Actual Moving Time Between Holes: 4 hrs.
Chargeable Moving Time " " : 2 hrs.
Quantity of Mud Used:

Remarks:-

Coal seams cored.
Top of Seam 4u shaved - prbly. eroded.

Probe Report:

822 - 0 ..... Gamma/Neutron ..... Open Hole
820 - 0 ..... Sidewall Densilog ..... Open Hole
820 - 0 ..... Caliper ..... Open Hole
822 -40 ..... E-Log ..... Open Hole

Coal Horizons

Coal Horizon	Drillers Picks		Log Picks		
Seam #2	205 - 225	20'	203 - 207 211 - 221	4') 10')	
Seam #4 Upper	460 - 475	15'	457 - 474	17')	
Seam #4 Lower	476 - 497	21'	476 - 487 491 - 494	11') 3')	) 37'
Seam #5	736 - 791	55'	734 - 750 757 - 790	16') 33')	56'

INTERVAL	UNIT THICKNESS	DESCRIPTION
0 - 76	76'	OVERBURDEN - Mainly brown to grey clay with some rock fragments basally.
76 - 160	84'	SANDSTONE - Very fine to medium grained - Greyish to brownish - Variably calcareous - Mainly subangular - Moderate to well sorted - Chert ≈ 2-5% - Limonite and hematite staining
160 - 176	16'	SHALE - Dark grey - Slightly silty - Thin coaly laminae
176 - 200	24'	SANDSTONE - Some siltstone at top - Calcite cement - Fine to medium grained - Grey to brown - Moderately sorted - Mainly subangular - Chert ≈ 2-5% - Variable limonite staining
200 - 205	5'	SHALE - Black - With coalified plant fragments
205 - 225	20'	COAL Seam #2 - Blocky to very shaly - Minor pyrite - Interbedded black coaly shales
225'- 230	5'	SHALE - Black - Coaly - Thin coaly laminae
230 - 240	10'	SILTSTONE - Dark grey - Argillaceous - Thin coaly laminae - Some interbedded black shale
240 - 405	165'	SANDSTONE - Mainly medium to coarse grained - Variable limonite staining - Medium grey - Siliceous cement - Poor to moderate sorting - Mainly subangular - Chert ≈ 5%

INTERVAL	UNIT THICKNESS	DESCRIPTION
405 - 420	15'	SILTSTONE - Medium grey - Sandy - Siliceous - With minor interbedded very fine sandstone
420 - 460	40'	SANDSTONE - Medium grained - Medium grey - Chert 2 -5% - Poor to moderate sorting - Subangular - Siliceous cement - Variable limonite and hematite stain
460 - 475	15'	COAL - Seam 4 Upper - Very shaly - Soft - In part quite muddy - Occasional blocky zones
475 - 476	1'	CLAY - Brown - Shaly
476 - 497	21'	COAL - Seam 4 Lower - Blocky to shaly - Part very fine - Abundant soft clay zones
497 - 504	7'	SHALE - Dark grey - Coaly - At 504 dip = 35° (assume vertical hole)
504 - 550	46'	SILTSTONE - Medium grey - Hard - In part argillaceous - Disseminated pyrite - Scattered coal particles - Cross bedded - Differential compaction structures - At 512 dip - 35° (assume vertical hole) - Some interbedded shale
550 - 595	45'	SANDSTONE - Very fine to medium grained - Poorly to well sorted - Medium Grey - Calcite cement - Mainly subangular - Chert $\approx$ 2-5%

INTERVAL	UNIT THICKNESS	DESCRIPTION
595 - 736	141'	SILTSTONE - Dark grey - Not limy - Possible thin coal stringers - Some interbedded shale - At 614 dip - 30° (assume vertical hole) - Minor interbedded sandstone
736 - 791	55'	COAL - Seam 5 - Some interbedded shale - In part very fine - In part clayey - Mainly blocky - In part shaly
791 - 827	36'	SANDSTONE - Loosely cemented and coaly at top - Medium grained - Light grey - Well sorted - Subrounded to rounded - 1 or 2% kaolinized feldspars - Porous - Siliceous cement
827		BOTTOM OF HOLE

ROTARY DRILL RECORD

Hole No.: 74-12

Property: Sage Creek Coal

Location: 17,846,263 N
585,978 E

Elevation: 4581'

Contractor: Becker Drilling Ltd.

Hole Size: 4-7/8" - 5-5/8"

Rig No.: 4520

Date Commenced Drilling: September 22, 1974

Date Finished Drilling: September 29, 1974

Date Hole Completed: September 29, 1974

Logged By: Jim Baker

Date: September 29, 1974

Probed By: Roke Oil Enterprises Ltd.

Date: September 29, 1974

Total Depth Drillers: 1160'

Depth of Overburden: 5'

Total Depth Logger: 1157'

Water Level: -

Bit Record

No.	Size	Make and Serial No.	R.P.M.	On	Off	Footage	Drilling Time

Surface Casing: 18'
Total Drilling Time: 162 hrs.
Total Down Time: 12 hrs.
Total Footage Chargeable: 1160'
Total Hourly Contact: 2 hrs.

Standby Time for Logging: 3 hrs.
Other Standby Time: -
Total Chargeable Standby Time: 3hrs.
Actual Moving Time Between Holes: 3 hrs.
Chargeable Moving Time " " : 2 hrs.
Quantity of Mud Used:

Remarks:-
Tertiary clays to 260'; @ 260'-290'
Erosion Zone.
Coal Horizon 5 Split into 2 seams.

Probe Report:

1155 - 0 .....Gamma/Neutron .....Thru Double Walled Pipe

Coal Horizons

Coal Horizon	Drillers Picks		Log Picks	
Seam #2	478 - 490	12'	474 - 486	12'
Seam #4	695 - 767	72'	698 - 738 743 - 762	40') 64' 19')
Seam #5	1013 - 1077	64'	1002 - 1024 1054 - 1072	22' 18'

INTERVAL	UNIT THICKNESS	DESCRIPTION
0 - 255	255'	TERTIARY CLAYS - Lt. & dk gy - Red - Olive
255 - 430	175'	SANDSTONE - Interbedded Slt-St - M - c gr. - Chert & qtz. - Silica cmt. - Abd limonite Fe st throughout - Sub angular - Blocky chips
430 - 478	38'	SILTSTONE - Lt gy - buff colored - Interbedded Sh
478 - 490	12'	COAL - Abd py. - Dirty
490 - 670	180'	SANDSTONE - Interbedded Slt St - M gy - C gr - chert & qtz. - Abd Fe St frags (weathered) - Tr coal & calcite - Silica cmt - Sub ang. p. sorted
670 - 695	25'	SILTY SHALE - Lt gy - Abd clay - Abd micro-muscovite
695 - 767	72'	COAL - Tr Fe st SS (Probably cavings) - Shaley toward bottom
767 - 800	33'	NO RECOVERY
800 - 1013	213'	SHALE - Coal str (845-870) - Abd clay - Abd Fe st material - Tr marcasite
1013 - 1077	64'	COAL - Abd sh & clay present - Argil & dirty
1077 - 1100	23'	SHALE & SS - Lt - m gy - Argil - Abd micro-muscovite - Tr clay & marcasite

INTERVAL	UNIT THICKNESS	DESCRIPTION
1100 - 1125	25'	SANDSTONE - Lt gy - M gr - Round - sub rounded - Qtz mostly - Silica cmt - W sorted - Tr calcite
1125 - 1160	35'	SHALE - Lt gy - Abd micro-muscovite - Abd clay - Chert frags

ROTARY DRILL RECORD

Hole No.: 74-13A & 13B

Property: Sage Creek Coal

Location: 17,845,410N) approximate
581,177E)

Elevation: N 5597' as.l

Contractor: Becker Drills Ltd.

Hole Size: 4 7/8"-5 5/8"

Rig No.: 4515

Date Commenced Drilling: September 13, 1974

Date Finished Drilling: September 15, 1975

Date Hole Completed: Abandoned

Logged By: J. Baker

Date: September 15, 1974

Probed By: Not probed

Date: --

Total Depth Drillers: 74-13A-170'
74-13B-70'

Depth of Overburden: N 10'

Total Depth Logger:

Water Level:

Bit Record

No.	Size	Make and Serial No.	R.P.M.	On	Off	Footage	Drilling Time

Surface Casing: 10'
Total Drilling Time: 35 hrs.
Total Down Time: --
Total Footage Chargeable: 240'
Total Hourly Contact: 9 hrs.

Standby Time for Logging:
Other Standby Time: 3 3/4 hrs
Total Chargeable Standby Time: 3 3/4 hrs
Actual Moving Time Between Holes: 3 hrs.
Chargeable Moving Time " " : 2 hrs.
Quantity of Mud Used:

Remarks:-

Excessive Caving and loss of circulation
Necessitated skidding hole after 170' drilled.
New hole abandoned @ 70' in badly brocken ground.

Probe Report:

Coal Horizons

Coal Horizon	Drillers Picks		Log Picks	

HOLE 74-13A

INTERVAL	UNIT THICKNESS	DESCRIPTION
0 - 10	10'	OVERBURDEN - glacial till - clay
10 - 15	5'	SILTSTONE - m. - dk. gy., Fe stn. - minor calcite - micro micaceous - large irregular fragments - possible brocken zone
15 - 85	70'	SANDSTONE - lt.-m. gy., abundant Fe stn. - weathered throughout unit - large irregular fragments suggestive of brocken zone. - qtz. & chert - a-r gr. - sil. cmt. - in part surrounded by clay matrix. - tr. coal frags. nr. surface - c. gr. near base.
85 - 170	85'	SILTSTONE (Inconclusive) - lt.-dk. gy. weathered appearance throughout - abundant Fe stn. - abundant clay material - micro-mica - abundant frags. of ss & sh with some chert and qtzte. - typically with v. large frags. - calcite frags scattered throughout. - minor py. & marcasite.
170'		Hole abandoned and skidded 30 feet south.

HOLE 74-13B

INTERVAL	UNIT THICKNESS	DESCRIPTION
0 - 15	15'	OVERBURDEN - Glacial till - clay - some coal wash
15 - 25	10'	COAL - weathered - dull - intermixed with ss & sh. - Fe stn.
25 - 35	10'	SHALE - weathered - tr. coal - abundant ss frags. - Fe stn. - some micro-muscovite - calcite and sltst. frags.
35 - 40	5'	MIXTURE - lrg. brocken frags. - chert, ss., sltst. sh & some calcite. - abundant clay - frags are weathered/abndt. Fe stn.
40 - 70	30'	SANDSTONE - m. gy., abundant Fe. stn. - mostly lrge. frags. - m. - c gr. in part v.c. - chert & qtz. - a - r gr. - p. sort. - minor shl. sltst. - tr. coal & calcite
70'		HOLE ABANDONED

ROTARY DRILL RECORD

Hole No.: 74-13C

Property: Sage Creek Coal

Location: 17,845,410N
581,177E

Elevation: 5597 asl.

Contractor: Becker Drills

Hole Size: 4 7/8" - 5 5/8"

Rig No.: 4515

Date Commenced Drilling: September 20, 1974

Date Finished Drilling: September 22, 1974

Date Hole Completed: Abandoned

Logged By: J. Baker

Date: September 22, 1974

Probed By: Roke Oil Enterprises

Date: September 22, 1974

Total Depth Drillers: 131'

Depth of Overburden: N 10'

Total Depth Logger: 130'

Water Level:

Bit Record

No.	Size	Make and Serial No.	R.P.M.	On	Off	Footage	Drilling Time

Surface Casing: 10'
Total Drilling Time: 15 hrs.
Total Down Time: --
Total Footage Chargeable: 131
Total Hourly Contact: 7½ hrs.

Standby Time for Logging: 2 hrs.
Other Standby Time: 35½ hrs.
Total Chargeable Standby Time: 36½ hrs.
Actual Moving Time Between Holes: 1 hr.
Chargeable Moving Time " " : --
Quantity of Mud Used:

Remarks:- Third attempt at location. Hole abandoned @ 130 due to excessive caving and loss of circulation

Probe Report:

130 - 0 ..... Gamma/Neutron ..... Thru Double Wall Pipe

Coal Horizons

Coal Horizon	Drillers Picks		Log Picks	

HOLE 74-13C

INTERVAL	UNIT THICKNESS	DESCRIPTION
0 - 10'	10'	SHALE - m. gy., abundant Fe stn. - slty. - sltst. & ss frags. - abundant coal
10 - 24'	14'	COAL - dirty - soft - shaly sh - 18' - 20'
24 - 80'	56'	SLTST., SS. SH & COAL - abundant frags of ss, sltst, sh. & coal throughout - badly caved - Fe stn.
80 - 131'	51'	SANDSTONE - m. gy., abundant Fe stn. - m - c gr. - qtz. & chert - r - A gr., p. sort. - sil. cmt. - badly brocken - sltst, shale & coal frags throughout interval - badly caved
131'		Hole Abandoned

ROTARY DRILL RECORD

Hole No.: 74 - 14

Property: Sage Creek Coal

Location: 17,845,480N
583,994E

Elevation: 4996'

Contractor: Becker Drilling Ltd.

Hole Size: 4 7/8" - 5 5/8"

Rig No.: 4518

Date Commenced Drilling: Oct. 6, 1974

Date Finished Drilling: Oct. 10, 1974

Date Hole Completed: Oct. 11, 1974

Logged By: Richard S. Blakeney

Date: Oct. 11, 1974

Probed By: Roke Oil Enterprises

Date: Oct. 10, 1974

Total Depth Drillers: 671

Depth of Overburden: 30

Total Depth Logger: 671

Water Level: Full

Bit Record

No.	Size	Make and Serial No.	R.P.M.	On	Off	Footage	Drilling Time

Surface Casing: 16 ft.
Total Drilling Time: 120 hrs.
Total Down Time: ——
Total Footage Chargeable: 671'
Total Hourly Contact: 5 hrs.

Standby Time for Logging: 1 hr.
Other Standby Time: ——
Total Chargeable Standby Time: 1 hr.
Actual Moving Time Between Holes: 14½ hr
Chargeable Moving Time " " : 12½ hr
Quantity of Mud Used:

Remarks:-
Probable fault @ 220'
Approx. 80' of strata displaced

Probe Report:

669 - 0 Gamma/Neutron Thru Double Wall Pipe

Coal Horizons

Coal Horizon	Drillers Picks	Interval	Log Picks		
Seam 2	——	——	213 - 216	3	
Seam 4 Upper	322 - 362	40	318 - 342	24)	36
Seam 4 Lower	374 - 378	4	346 - 354	8)	
			371 - 380	9	
Seam 5	590 - 596	6)	584 - 632	48	
	606 - 610	4)			

INTERVAL	UNIT THICKNESS	DESCRIPTION
0' - 45'	45'	Sandstone - silty from 5' - 15' - f. gr., lt. gy. - qtz. & chert, silica matrix - sub angular, abd. Fe. st. - well sorted - argil. - 30' - 45' possible frac. zone
45' - 80'	35'	Shale - somewhat silty - m. gy., weathered. (frac. zone 50'-55') - tr. micro-mica (Muscovite) - abd. coal frags. present.
80' - 142'	62'	Coal - black - dirty - dull luster
142' - 342'	200	Shale - m. dk. gy. - quite silty in places - abd. micro-mica (Muscovite) Coal Stringers @ - 160' - 165' - 185' - 190' - 210' - 215' - 235' - 240' - Fe. st. throughout (chert frags.) - Quik seal abd. starting at 285'
342' - 390'	48	Coal - black - m. soft - abd. Quick Seal present - abd. shale present
390' - 413'	23'	Sandstone - v.f. - f. gr. - chert & qtz., silica cement - well sorted - abd. sh. & coal present - calcite present - minor Fe. st.

ROTARY DRILL RECORD

Hole No.: 74-04

Property: SAGE CREEK COAL

Location: South Hill
17,847,868 N
584,399 E

Elevation: 5,049'

Contractor: Becker Drills Ltd.

Hole Size: 5-1/8" - 5-5/8"

Rig No.: 4520

Date Commenced Drilling: September 12, 1974

Date Finished Drilling: September 14, 1974

Date Hole Completed: September 14, 1974

Logged By: D. Tate & O. Cullingham

Date: September 12-17, 1974

Probed By: Roke Oil Enterprises Ltd.

Date: September 14, 1974

Total Depth Drillers: 604'

Depth of Overburden: < 5'

Total Depth Logger: 599'

Water Level: 214' or Elev. 4835.

Bit Record

No.	Size	Make and Serial No.	R.P.M.	On	Off	Footage	Drilling Time

Surface Casing: 15'
Total Drilling Time: 60 hrs.
Total Down Time: -
Total Footage Chargeable: 604'
Total Hourly Contact: 3½ hrs.

Standby Time for Logging: 4 hrs.
Other Standby Time: 7 hrs.
Total Chargeable Standby Time: 11 hrs.
Actual Moving Time Between Holes: 1½ hrs
Chargeable Moving Time " " : ½ hr.
Quantity of Mud Used:

Remarks:-

Possible fault @ 490'
Approx. 50'-70' of strata displaced

Probe Report:

599 - 0	.....	Gamma/Neutron	Through Double Walled Pipe.
598 - 0	.....	Sidewall Densilog	Open Hole
598 - 0	.....	Caliper	Open Hole
595 -107	.....	E-Log	Open Hole

Coal Horizons

Coal Horizon	Drillers Picks		Log Picks		
Seam 2	108 - 126	18'	109 - 118	9'	
Seam 4 Upper	339 -	55'	333 - 356	23')	50'
4 Lower	- 394		363 - 383	20')	
Seam 5	530 - 577	47'	528 - 542	14')	46'
			550 - 574	24')	

INTERVAL	UNIT THICKNESS	Hole 74 - 14 DESCRIPTION	PAGE 1
0 - 30	30	OVERBURDEN	
30 - 310	280	SANDSTONE - minor siltstone stringers - mainly medium grained - siliceous cement - brown to grey - subangular mainly - very porous - moderately sorted - chert ≈2-5%	
310 - 322	12	SHALE - dark grey - thin coal stringers becoming more abundant basally	
322- 360	38	COAL - Seam 4 upper - in part with conchoidal fracture - in part shaly - minor pyrite - some thin interbeds of shale and siltstone	
360 - 371	11	SILTSTONE - medium grey - siliceous - hard - minor dark grey coaly shale	
371 - 380	9	COAL - Seam 4 lower - mainly blocky	
380 - 432	52	SILTSTONE - medium to dark grey - hard - siliceous cement	
432 - 475	43	SANDSTONE - very fine to medium grained - light grey - chert ≈2-5% - slightly calcareous - subrounded - moderately sorted - minor limonite	
475 - 495	20	SHALE - dark grey - minor sericite - some coaly laminat ons	
495 - 554	59	SILTSTONE - medium grey - argillaceous - fairly soft	

INTERVAL	UNIT THICKNESS	Hole 74-14 DESCRIPTION PAGE 2
554 - 580	26	SANDSTONE - very fine to medium grained - poor to moderate sorting - light grey - very slightly calcareous - mainly siliceous cement - angular to subrounded - chert ≈2-5%
580 - 584	4	SHALE - dark grey - coaly - micaceous
584 - 632	48	COAL - Seam 5 - blocky to shaly - some with conchoidal fracture - 10 feet of sandstone and shale from 596 to 606
632 - 671	39	SANDSTONE - light grey - more coaly and darker grey toward top - siliceous cement - kaolinized feldspars common - fine to medium grained - well sorted - sub rounded
671		BOTTOM OF HOLE

RIO TINTO CANADIAN EXPLORATION LIMITED

ROTARY DRILL RECORD

Hole No.: 74-15 Property: Sage Creek Coal

Location: 17,845,473 N
585,990 E Elevation: 4657'

Contractor: Becker Drilling Ltd. Hole Size: 4-7/8" - 5-5/8"

Rig No.: 45-20

Date Commenced Drilling: October 11, 1974

Date Finished Drilling: October 17, 1974

Date Hole Completed: October 17, 1974

Logged By: Jim Baker Date: October 17, 1974

Probed By: Roke Oil Enterprises Ltd. Date: October 17, 1974

Total Depth Drillers: 1135' Depth of Overburden: 40'

Total Depth Logger: 1133' Water Level: 7' or elev. 4650'

Bit Record

No.	Size	Make and Serial No.	R.P.M.	On	Off	Footage	Drilling Time

Surface Casing: 20'
Total Drilling Time: 150 hrs.
Total Down Time: 4 hrs.
Total Footage Chargeable: 1135'
Total Hourly Contact: 3 hrs.

Standby Time for Logging: 9½ hrs.
Other Standby Time: -
Total Chargeable Standby Time: 9½ hrs.
Actual Moving Time Between Holes: 8hrs.
Chargeable Moving Time " " : 6 "
Quantity of Mud Used:

Remarks:-
820' of clay before entering Kootenay Fm.
Probable lower bench of seam 5 below 1140'

Probe Report:

1130 - 0	Gamma/Neutron	Thru Double Walled Pipe
1126 - 0	Sidewall Densilog ...	Open Hole
1126 - 0	Caliper	Open Hole
1126 - 54	E - Log	Open Hole

Coal Horizons

Coal Horizon	Drillers Picks		Log Picks		
Seam 5	1062 - 1090	28	1042 - 1057 1061 - 1070	15') 9')	28

INTERVAL	UNIT THICKNESS	DESCRIPTION
0 - 40	40'	OVERBURDEN
40 - 860	820'	CLAY - Tertiary - Blue-grey color
860 - 1062	202	CHERT FRAGS & CLAY - M gy - Abd clay
1062 - 1090	28'	COAL - Tr marcasite
1095 - 1140	45'	SHALE - Dk gy - Abd micro-muscovite

ROTARY DRILL RECORD

Hole No.: 74-16

Property: Sage Creek Coal

Location: 17,844,650N
581,983E

Elevation: 5242' asl

Contractor: Becker Drills Ltd.

Hole Size: 4 7/8"-5 1/8"

Rig No.: 4518

Date Commenced Drilling: September 28, 1974

Date Finished Drilling: September 30, 1974

Date Hole Completed: September 30, 1974

Logged By: O. Cullingham

Date: September 30, 1974

Probed By: Roke Oil Enterprises

Date: September 30, 1974

Total Depth Drillers: 435

Depth of Overburden: --

Total Depth Logger: 435

Water Level: 130' or elev. 5112'

Bit Record

No.	Size	Make and Serial No.	R.P.M.	On	Off	Footage	Drilling Time

Surface Casing: 15'
Total Drilling Time: 38 hrs.
Total Down Time:
Total Footage Chargeable: 435'
Total Hourly Contact: 15 hrs.

Standby Time for Logging: 2 hrs.
Other Standby Time: --
Total Chargeable Standby Time: 2 hrs.
Actual Moving Time Between Holes: 6½ hr.
Chargeable Moving Time " " : 5½ hr.
Quantity of Mud Used:

Remarks:-
Possible slump in hole
causing repetition of basal ss.

Probe Report:

434-0 ..... Gamma/Neutron..... Thru Double Wall Pipe

Coal Horizons

Coal Horizon	Drillers Picks		Log Picks	

INTERVAL	UNIT THICKNESS	DESCRIPTION
0 - 25	25'	SHALE - m. to dk. gy., - wthrd. to buff brn.- lmn, stn. - sl. micro-mica - lrg. broken frags. - sl. carb. to coaly in part
25 - 70	45'	SILTSTONE - m. dk. gy. - v. sl. micro-mica - lrg. frags. - grades downward to v.f. gr. ss.
70 - 230	160'	SANDSTONE - m. bm. gy., wthrd. appearance, Fe stn. - v.f. to f. gr. - arg. matrix - qtz. with few chert gr. - frags of ltst & sh. throughout. 100-110 large broken frags. 160-170 large broken frags. 190-200 apparent broken zone.
230 - 350		SILTSTONE/SHALE INTERBEDS - m. to m. dk gy., - in part with wthrd. appearance - minor py. - sl. micro-mica. - some zones of abundant sandstone frags - possible cavings. - becomes progressively shaly downwards.
350 - 435		SHALE - m. dk. gy. - blocky - sl. micro-mica & mod. micro-mica towards bottom of hole - minor calcite veinlets.
435		T.D.

RIO TINTO CANADIAN EXPLORATION LIMITED

ROTARY DRILL RECORD

Hole No.: 74 - 17

Property: Sage Creek Coal

Location: 17,844,661N
582 800E

Elevation: 5086'

Contractor: Becker Drilling Ltd.

Hole Size: 4 7/8" - 5 1/8"

Rig No.: 4520

Date Commenced Drilling: Oct. 9, 1974

Date Finished Drilling: Oct. 10, 1974

Date Hole Completed: Oct. 11, 1974

Logged By: Jim Baker

Date: Oct. 11, 1974

Probed By: Roke Oil Enterprises Ltd.

Date: Oct. 11, 1974

Total Depth Drillers: 338'

Depth of Overburden: 60'

Total Depth Logger: 334'

Water Level: Full

Bit Record

No.	Size	Make and Serial No.	R.P.M.	On	Off	Footage	Drilling Time

Surface Casing: 40'
Total Drilling Time: 38 hrs.
Total Down Time: ——
Total Footage Chargeable: 338'
Total Hourly Contact: ——

Standby Time for Logging: 1 hr.
Other Standby Time: ——
Total Chargeable Standby Time: 1 hr.
Actual Moving Time Between Holes: 12½ hr
Chargeable Moving Time " " :
Quantity of Mud Used: 10½ hr

Remarks:- Bad down hole sloughing
No coal recovered from Seam 5

Probe Report:

334 - 0 - Gamma/Neutron - Thru Double Walled Pipe

Coal Horizons

Coal Horizon	Drillers Picks		Log Picks	
Seam #5	193 - 236	43'	200 - 232	32

INTERVAL	UNIT THICKNESS	DESCRIPTION
0 - 60	60'	OVERBURDEN
60 - 100	40'	SANDSTONE - m. dk. gy. - chert & qtz. - silica cmt. - Sub ang. - p. sorted - c gr. - fair porosity
100 - 193	93'	SHALE - m. dk. gy. - abd. micro-muscovite - tr. coal & abd. fe st, ss - grading to silty throughout
193 - 236	43'	COAL - 193' - 200' abd. sh. - Sh. str. 210' - 214'
236 - 290	54'	SANDSTONE (Basal) - dk gy - qtz & Chert - silica cmt - fn - m, gr. - m. sorting - tr muscovite - tr. fe st& calcite
290 - 338	48'	SILTY SH - mgy abd, micro-muscovite - tr coal & abd silt & v. fn. gr. ss.

ROTARY DRILL RECORD

Hole No.: 74 - 18

Property: Sage Creek Coal

Location: 17,844,668N
583,607E

Elevation: 5011' asl

Contractor: Becker Drills Ltd.

Hole Size: 4 7/8" - 5 1/8"

Rig No.: 4518

Date Commenced Drilling: September 30, 1974

Date Finished Drilling: October 5, 1974

Date Hole Completed: October 5, 1974

Logged By: O. Cullingham

Date: October 5, 1974

Probed By: Roke Oil Enterprises Ltd.

Date: October 5, 1974

Total Depth Drillers: 801'

Depth of Overburden:

Total Depth Logger: 800'

Water Level: Full

Bit Record

No.	Size	Make and Serial No.	R.P.M.	On	Off	Footage	Drilling Time

Surface Casing: 20'
Total Drilling Time: 86 hrs.
Total Down Time: 24 hrs.
Total Footage Chargeable: 801'
Total Hourly Contact: 11½ hrs.

Standby Time for Logging: 4½ hrs.
Other Standby Time: ----
Total Chargeable Standby Time: 4½ hrs.
Actual Moving Time Between Holes: 6 hrs.
Chargeable Moving Time " " : 4 hrs.
Quantity of Mud Used:

Remarks:- Kishenehn Clays to 290'
Possible erosion zone 290'-370'
No coal recovery from seam 5

Probe Report:

798 - 0 ..... Gamma/Neutron ..... Thru Double Wall Pipe

Coal Horizons

Coal Horizon	Drillers Picks		Log Picks	
Seam 5	----	----	506' - 516' 531' - 547'	10' 16'

HOLE 74 - 18

INTERVAL	UNIT THICKNESS	DESCRIPTION
0 - 15	15'	OVERBURDEN - glacial till - clay - fill
15 - 60	45'	SHALE, SLTST, CHERT, SANDSTONE - probably glacial derived debris - small ground fragments - well rounded to very angular frags. - in part imbedded in clay matrix - wthrd. appearance - heavily Fe stn.
60 - 290	230'	CLAY - KISHENEHN FORMATION - green gray to olive - short intervals of brown and maroon clays. - sl. to v. calc. - swells when wet - plasticine texture
290 - 350	60'	SANDSTONE - m. gy. bm.,, wthrd., Fe stn. - c. to congl. ss. - dissaggregated frags. - frags imbedded in clay matrix - possible erosion surface
350 - 400	50'	SANDSTONE - m. to m. dk. gy., - in part Fe stn. - m - c gr. - qtz. & chert gr. - sil. cmt., arg. matrix - in part to conglomeratic - carb sh. frags. - in part dissaggregated
400 - 430	30'	SANDSTONE - m. gy, some wthrd & Fe stn. frags. - f gr., in part to m. gr. - qtz. & chert gr. - sil. cmt , - few carb. sh. frags. - some fractured frags.
430 - 490	60'	SANDSTONE - m. to m. dk. gy. - m gr. to conglomeratic - dissaggregated congl. - Fe stn but with little wthrg. apparent - qtz. & chert gr. - sil cmt. - few carb. sh. frags.

HOLE 74 - 18

INTERVAL	UNIT THICKNESS	DESCRIPTION
490 - 550	60'	SHALE, SILTSTONE, CARB. SHALE, COAL - assortment of fragments - unit appears to consist mainly of shale and siltstone with interbeds of carbonaceous shale and thin coal partings - badly caved - Gamma/Neutron Log indicates Seam 5 in this interval.
550 - 590	40'	SANDSTONE - m. gy., - f. gr., - qtz. few chert gr. - a mod. sort., - silica cmt, hd. - few frags coaly shale - some chert frags, - Fe stn.
590 - 690	100'	SANDSTONE, SILTSTONE AND CONGLOMERATE - mixture of fragments - m. dk. gy., some Fe stn. - pbls. of chert., - p. sort., - Fe stn. of chert pbls. - wthrd. appearance-cavings? - probably Passage Beds.
690 - 800	110'	SHALE - dk. gy. - slty, - sl. micro-mica - v. sl. chloritic - some sandstone&siltstone frags - some wthrd & Fe stn ptcls. p bly cavings. - unit becomes more micaceous downwards - Fernie Shale
801		T.D.

RIO TINTO CANADIAN EXPLORATION LIMITED

ROTARY DRILL RECORD

Hole No.: 74-20

Property: Sage Creek Coal

Location: 17,844,644N
585,188E

Elevation: 4797'

Contractor: Becker Drilling Ltd.

Hole Size: 4 7/8" - 5 1/8"

Rig No.: 45 - 20

Date Commenced Drilling: Oct. 4, 1974

Date Finished Drilling: Oct. 9, 1974

Date Hole Completed: Oct. 9, 1974

Logged By: Jim Baker

Date: Oct. 9, 1974

Probed By: Roke Oil Enterprises Ltd.

Date: Oct. 9, 1974

Total Depth Drillers: 818'

Depth of Overburden: 15'

Total Depth Logger: Only got to 756'

Water Level: 18' or 4779' elev.

Bit Record

No.	Size	Make and Serial No.	R.P.M.	On	Off	Footage	Drilling Time

Surface Casing: 30'
Total Drilling Time: 114 hrs.
Total Down Time: ———
Total Footage Chargeable: 818'
Total Hourly Contact: 2 hrs.

Standby Time for Logging: 2 hrs.
Other Standby Time: ———
Total Chargeable Standby Time: 2 hrs.
Actual Moving Time Between Holes: 6½ hr.
Chargeable Moving Time " " : 4½ hr.

Remarks:- Hole abandoned @ 820'
Intersected Kishenehn Fm. only

Probe Report:

755 - 0 - Gamma/Neutron - Open Hole

Coal Horizons

Coal Horizon	Drillers Picks		Log Picks	

INTERVAL	UNIT THICKNESS	DESCRIPTION
0 - 15	15	OVERBURDEN - glacial clays & drift
15 - 120	105	TERTIARY CLAY - light gray to light olive gray - plasticine texture - in part sl. calc. - abundant pcls. of chert, qtz., ss, & sltst.- little ls., lrg. rnd. frags. Fe. stn.
120 - 170	50	No recovery- Clay - fine frags ss, qtz, chert, sh. & sltst. imbedded in green gray clay.
170 - 190	20	TERTIARY CLAY - As. for 15 - 120
190 - 200	10	Mixture of frags. - little clay;abndt. coal - dirty.
200 - 818	618	TERTIARY CLAY - Mixture of ss, chert, qtz., few ls. sltst. & sh. frags. - Angular to well rnd. - Fe. stn. in part, some muscovite present - Imbedded in a clay matrix. - tr. coal @ 360 480 600 760

RIO TINTO CANADIAN EXPLORATION LIMITED

ROTARY DRILL RECORD

Hole No.: 74 - 21

Property: Sage Creek Coal

Location: North Hill
17,858,252N
586,008E

Elevation: 4649'

Contractor: Becker Drills Ltd.

Hole Size: 5 1/8"

Rig No.: 4515

Date Commenced Drilling: Oct. 11, 1974

Date Finished Drilling: Oct. 12, 1974

Date Hole Completed: Oct. 12, 1974

Logged By: G. Switzer

Date: Oct. 12, 1974

Probed By: Roke Oil Enterprises Ltd.

Date: Oct. 12, 1974

Total Depth Drillers: 118

Depth of Overburden: 8'

Total Depth Logger: 117

Water Level: Full

Bit Record

No.	Size	Make and Serial No.	R.P.M.	On	Off	Footage	Drilling Time

Surface Casing: 9'
Total Drilling Time: 15 hrs.
Total Down Time: ———
Total Footage Chargeable: 118
Total Hourly Contact: ———

Standby Time for Logging: 1½ hrs.
Other Standby Time: ———
Total Chargeable Standby Time: 1½ hrs.
Actual Moving Time Between Holes: 6½ hrs
Chargeable Moving Time " " : 4½ hr.
Quantity of Mud Used:

Remarks:- Collared 40' to 60' below base of Seam 5.

Probe Report:

115 - 0 Gamma/Neutron Thru Double Walled Pipe

Coal Horizons

Coal Horizon	Drillers Picks		Log Picks	

INTERVAL	UNIT THICKNESS	Hole 74-21 DESCRIPTION	PAGE 1
0 - 15'	15'	NO SAMPLES AVAILABLE	
15' - 50'	35'	SANDSTONE INTERBEDDED WITH SILTY SANDSTONE SILTY SHALE AND SHALE SS - very fine grained, well sorted mostly quartz but some chert light to medium grey in colour; limonite cement, poor porosity, good porosity near surface probably due to leaching. limonite stains and a trace of marcasite. sandstone is the largest fraction. SILTY SS - medium grey with traces of marcasite. SILTY SHALE - medium grey SHALE - medium to dark grey with abundant mica (muscovite) - most abundant at 30' and 50'. - thin beds.	
50' - 115'	65'	MOSTLY SILTSTONE WITH INTERBEDDED SHALE, SILTY SHALE, AND SOME SILTY SS. SILTSTONE - medium grey 60% SHALE - medium to dark grey, micaceous (muscovite) with traces of calcite and marcasite SILTY SANDSTONE - medium grey, mostly chert, thin bed.	

RIO TINTO CANADIAN EXPLORATION LIMITED

ROTARY DRILL RECORD

Hole No.: 74 - 22

Property: Sage Creek Coal

Location: North Hill
17,858,203N
586,783E

Elevation: 4460'

Contractor: Becker Drills Ltd.

Hole Size: 5 1/8'

Rig No.: 4515

Date Commenced Drilling: Oct. 1, 1974

Date Finished Drilling: Oct. 10, 1974

Date Hole Completed: Oct. 10, 1974

Logged By: G. Switzer

Date: October 10, 1974

Probed By: Roke Oil Enterprises Ltd.

Date: October 10, 1974

Total Depth Drillers: 360'

Depth of Overburden: 10'

Total Depth Logger: 356'

Water Level: full

Bit Record

No.	Size	Make and Serial No.	R.P.M.	On	Off	Footage	Drilling Time

Surface Casing: 10"
Total Drilling Time: 91 hrs.
Total Down Time: 124 hrs.
Total Footage Chargeable: 360'
Total Hourly Contact: 4 hrs.

Standby Time for Logging: 1 hr.
Other Standby Time: ——
Total Chargeable Standby Time: 1 hr.
Actual Moving Time Between Holes: 11½ hr
Chargeable Moving Time " " : 9½ hrs
Quantity of Mud Used:

Remarks:-

Seam 5 thinned - due to erosion.

Probe Report:

354 - 0	Gamma/Neutron	Thru Double Walled Pipe
71 - 0	Sidewall Density	Open Hole
71 - 0	Caliper	Open Hole

Coal Horizons

Coal Horizon	Drillers Picks		Log Picks	
Seam # 5	64 - 80	16'	60 - 70	10

INTERVAL	UNIT THICKNESS	DESCRIPTION
0 - 60'	60'	SANDSTONE - white fine grained, rounded well sorted quartz grains with abundant chert fragments silica cement trace of Fe stain trace of shale
60' - 80'	20'	COAL - abundant sh + ss frags. SANDSTONE - coarse grained with abundant chert SHALE - small amount - traces of marcasite
80' - 150'	70'	SANDSTONE - medium grained, dark grey, mostly chert, some quartz - sub angular, poorly sorted - silica cement - traces of coal and light chert fragments SHALE - few thin interbeds - micaceous - traces of calcite - white - traces of Fe stain - traces of coal
150' - 360'	210'	mostly siltstone - medium to dark grey thin beds of shale or silty shale light to dark grey in colour - traces of calcite white - thin beds of silty sandstone dark grey - traces of very fine grained sandstone dark grey mostly chert - traces of Fe staining - traces of limonite staining

RIO TINTO CANADIAN EXPLORATION LIMITED

ROTARY DRILL RECORD

Hole No.: 74-23

Property: Sage Creek Coal

Location: North Hill
17,857,438N
585,257E

Elevation: 4944'

Contractor: Becker Drilling Ltd.

Hole Size: 4 7/8" - 5 1/8"

Rig No.: 4515

Date Commenced Drilling: Sept. 30/74 4 p.m.

Date Finished Drilling: Oct. 1/74 9 a.m.

Date Hole Completed: Oct. 1/74

Logged By: Jim Baker

Date: Oct. 1/74

Probed By: Roke Oil Enterprises Ltd.

Date: Oct. 1/74

Total Depth Drillers: 190'

Depth of Overburden: 12'

Total Depth Logger: 190'

Water Level: 28' or elev. 4916

Bit Record

No.	Size	Make and Serial No.	R.P.M.	On	Off	Footage	Drilling Time

Surface Casing: 4
Total Drilling Time: 40 hrs.
Total Down Time: ———
Total Footage Chargeable: 190'
Total Hourly Contact: ———

Standby Time for Logging: 4 hrs.
Other Standby Time: ———
Total Chargeable Standby Time: 4 hrs.
Actual Moving Time Between Holes: 10 hrs
Chargeable Moving Time " " : 8 hrs.
Quantity of Mud Used:

Remarks:-

Probe Report:

188 - 0	Gamma/Neutron	Thru Double Walled Pipe
188 - 0	Sidewall Density	Open Hole
188 - 0	Caliper	Open Hole
189 - 55	E-Log	Open Hole

Coal Horizons

Coal Horizon	Drillers Picks		Log Picks	
Seam #5	105 - 158	53'	94-114 120-150	20') 56' 30')

INTERVAL	UNIT THICKNESS	DESCRIPTION
0' - 105'	105'	SHALE - interbedded slt. st. - dk. gy. - abd. micro muscovite - tr. Fe. st.
105' - 158'	53'	COAL Seam 5
158' - 190'	32'	SS - lt. m. gy. - qtz. mainly (chert present) - silica cmt. - sub rounded - w. sorted - tr. sh. & calcite - tr. fe. st.

ROTARY DRILL RECORD

Hole No.: 74 - 24

Property: Sage Creek Coal

Location: North Hill
17,857,421N
586,008E

Elevation: 4847

Contractor: Becker Drilling Ltd.

Hole Size: 5 5/8"

Rig No.: 45 - 20

Date Commenced Drilling: Oct. 24, 1974

Date Finished Drilling: Oct. 27, 1974

Date Hole Completed: Oct. 28, 1974

Logged By: Jim Baker

Date: Oct. 28, 1974

Probed By: Roke Oil Enterprises Ltd.

Date: Oct. 28, 1974

Total Depth Drillers: 656

Depth of Overburden:

Total Depth Logger: 653

Water Level: 10' or elev.4837'

Bit Record

No.	Size	Make and Serial No.	R.P.M.	On	Off	Footage	Drilling Time

Surface Casing: 5'
Total Drilling Time: 96 hrs.
Total Down Time: ———
Total Footage Chargeable: 656'
Total Hourly Contact: ———

Standby Time for Logging: 5 hrs.
Other Standby Time: 1 hr.
Total Chargeable Standby Time: 6 hrs.
Actual Moving Time Between Holes: 6 hrs.
Chargeable Moving Time " " : 4 hrs.
Quantity of Mud Used:

Remarks:-
Possible fault @ 470' displacing
Approx. 135' of strata - lower part of Seam 5 displaced.

Probe Report:

650 - 0	Gamma/Neutron	Thru Double Walled Pipe
650 - 0	Sidewall Densilog	Open Hole
650 - 0	Caliper	Open Hole
650 - 100	E - Log	Open Hole

Coal Horizons

Coal Horizon	Drillers Picks		Log Picks	
Seam #2	74 - 92	18'	70 - 90	20'
Seam #4	215 - 235	20'	211 - 234	23'
Seam #5	No samples		462 - 471	9'

HOLE 74-24

INTERVAL	UNIT THICKNESS	DESCRIPTION
0 - 30	30'	SANDSTONE - lt. gy. - salt & pepper appearance - med. grained - sub-rounded - silica cmt. - med. porosity - chert frags present - p. med. sorting - tr. Fe. st.
30 - 74	44'	SHALE - m. dk. grey - abd. micro muscovite - Fe. staining - tr. coal & marcasite
74 - 92	18'	COAL - shaley @ top & bottom of section
92 - 215'	123'	SILTY SHALE - m. gy. - abd. micro muscovite - angular grains - tr. marcasite - tr. calcite
215 - 235'	20'	COAL - tr. marcasite - 223'-227' (4') v. shaley coal
235 - 480	245'	SHALE - dk. grey - abd. micro muscovite - tr. marcasite - tr. calcite - around 330' grades to silty
480 - 655	175'	SANDSTONE - fr. med. grained - chert & qtz. - silica cmt. - sub-angular - p. sorted - m. dk. gy. - shale present - tr. marcasite - grades to shale near bottom of hole

ROTARY DRILL RECORD

Hole No.: 74 - 25

Property: Sage Creek Coal

Location: North Hill
17,857,457N
586,726E

Elevation: 4490'

Contractor: Becker Drilling Ltd.

Hole Size: 5 1/8"-5 7/8"

Rig No.: 45 - 20

Date Commenced Drilling: Oct. 17, 1974

Date Finished Drilling: Oct. 20, 1974

Date Hole Completed: Oct. 20, 1974

Logged By: Jim Baker

Date: Oct. 20, 1974

Probed By: Roke Oil Enterprises Ltd.

Date: Oct. 20, 1974

Total Depth Drillers: 601'

Depth of Overburden: < 5'

Total Depth Logger: 596'

Water Level: Full

Bit Record

No.	Size	Make and Serial No.	R.P.M.	On	Off	Footage	Drilling Time

Surface Casing: 10'
Total Drilling Time: 92 hrs.
Total Down Time: ———
Total Footage Chargeable: 601'
Total Hourly Contact: ———

Standby Time for Logging: 9½ hrs.
Other Standby Time: 3 hrs.
Total Chargeable Standby Time: 10½ hrs.
Actual Moving Time Between Holes: 4½ hrs
Chargeable Moving Time " " : 2½ hrs
Quantity of Mud Used:

Remarks:-
Probable fault @ 70' - 80'
Approx. 230 ' of strata sidplaced

Probe Report:

593 - 0	Gamma/Neutron	Open Hole
588 - 0	Sidewall Densilog	Open Hole
588 - 0	Caliper	Open Hole
588 - 36	E - Log	Open Hole

Coal Horizons

Coal Horizon	Drillers Picks		Log Picks		
Seam #2	24-30	6	14 - 17 19 - 26	3') 7')	12'
Seam #5	165 - 207	42'	160' - 172' 176' - 204'	12') 28')	44

INTERVAL	UNIT THICKNESS	HOLE 74-25 DESCRIPTION
0 - 10	10'	OVERBURDEN
10 - 24	14'	SLT. ST. - lt. m. gy. - abd. micro muscovite - silica cmt. - qtz. & chert
24 - 30	6'	COAL - tr. marcasite
30 - 165	135'	SLT. ST. & SHALE SHALE - dk. gy. - abd. micro muscovite - tr. coal SLT. ST. - m. gy. - silica cmt. - chert & qtz. matrix
165 - 207	42'	COAL - 179 - 187 - shaley
207 - 360	157'	SANDSTONE basal - m. gy. - fn.- m. gr. - chert & qtz. - sub rounded - m. sorting - silica cement
360 - 510	150'	SS & SLT. ST. & SH. (Passage Beds) SS -v. fn. gr. - m. gy. - qtz. & chert - silica cmt. - w. sorted - somewhat silty - tr. marcasite SLT. ST. - m. gy.
510 - 600	90'	SHALE Fernie - m. dk. gy. - abd. micro muscovite - tr. marcasite veinlets

ROTARY DRILL RECORD

Hole No.: 74 - 26

Property: Sage Creek Coal

Location: North Hill
17,856,591N
584,376E

Elevation: 5170'

Contractor: Becker Drilling Ltd.

Hole Size: 5 1/8"

Rig No.: 4515

Date Commenced Drilling: Oct. 12, 1974

Date Finished Drilling: Oct. 13, 1974

Date Hole Completed: Oct. 13, 1974

Logged By: Robert Talbot

Date: Oct. 13, 1974

Probed By: Roke Oil Enterprises Ltd.

Date: Oct. 13/74

Total Depth Drillers: 80'

Depth of Overburden: 14'

Total Depth Logger: 78

Water Level:6 ft. or elev.5164'

Bit Record

No.	Size	Make and Serial No.	R.P.M.	On	Off	Footage	Drilling Time

Surface Casing: 10'
Total Drilling Time: 14 hrs.
Total Down Time: ———
Total Footage Chargeable: 80'
Total Hourly Contact: ———

Standby Time for Logging: 3 hrs.
Other Standby Time: ———
Total Chargeable Standby Time: 3 hrs.
Actual Moving Time Between Holes: 6 hrs.
Chargeable Moving Time " " : 4 hrs.
Quantity of Mud Used:

Remarks:-

Probe Report:

70 - 0	Gamma/Neutron	Thru Double Walled Pipe
76 - 0	Sidewall Densilog	Open Hole
76 - 0	Caliper	Open Hole

Coal Horizons

Coal Horizon	Drillers Picks		Log Picks	
Seam # 5	22'-50'	28'	9' - 49'	40'

HOLE 74 - 26

INTERVAL	UNIT THICKNESS	DESCRIPTION
0 - 14'	14	Overburden
14 - 22	8'	SHALE - m. grey - abd. micro muscovite - tr. ss. - tr. marcasite - Fe. staining
22 - 50'	28'	COAL 22' -32' - abd. shale
50 - 55	5'	SHALE - m. to dk. grey - abd. micro muscovite - trace coal
60 - 80'	20'	SANDSTONE (basal) - m. grey - silica matrix - m. to well sorted - f. grained - poor porosity - qtz. - micro muscovite

ROTARY DRILL RECORD

Hole No.: 74 - 27

Property: Sage Creek Coal

Location: North Hill
17,856,684N
585,983E

Elevation: 4900'

Contractor: Becker Drilling Ltd.

Hole Size: 5 1/8" - 5 5/8"

Rig No.: 45 - 20

Date Commenced Drilling: Oct. 21, 1974

Date Finished Drilling: Oct. 24, 1974

Date Hole Completed: Oct. 24, 1974

Logged By: Rob Talbot

Date: Oct. 24, 1974

Probed By: Roke Oil Enterprises Ltd.

Date: Oct. 24, 1974

Total Depth Drillers: 576

Depth of Overburden:

Total Depth Logger: 575

Water Level: 262' or elev.4638'

Bit Record

No.	Size	Make and Serial No.	R.P.M.	On	Off	Footage	Drilling Time

Surface Casing: 7'
Total Drilling Time: 76 hrs.
Total Down Time: ——
Total Footage Chargeable: 576'
Total Hourly Contact: 8½ hrs.

Standby Time for Logging: 5 hrs.
Other Standby Time: ——
Total Chargeable Standby Time: 5 hrs.
Actual Moving Time Between Holes: 2 hrs.
Chargeable Moving Time " " : ——
Quantity of Mud Used:

Remarks:-
Bad down hole sloughing

Probe Report:

573 - 0	Gamma/Neutron	Thru Double Walled Pipe
255 - 0	Sidewall Densilog	Open Hole

Coal Horizons

Coal Horizon	Drillers Picks		Log Picks	
Seam #2	70 - 86	16'	66 - 84	18'
Seam #4 U	154'- 184'	30'	157-184	27'
Seam #4 L			224-234	10'
Seam #5	516' - 546'	30'	514-531	17') 35'
			538-549	11')

INTERVAL	UNIT THICKNESS	HOLE 74-27 DESCRIPTION	PAGE 1
0 - 20	10'	SANDSTONE - lt. gy. - poorly sorted - silica cement - m. gr. - angular - tr. chert	
20 - 70	50'	SHALE - m. grey - abd. micro muscovite - Fe. st. - 30% SS AA	
70 - 86	16'	COAL - shaley thru out	
86 - 154	68'	SHALE - dk. grey - abd. micro muscovite	
154 - 184'	30'	COAL	
184 - 350	166'	SHALE - m. dk. grey - abd. micro muscovite - trace coal 230 - 250 (? 4 lower)	
350 - 400'	50	SANDSTONE - lt. grey - silica cement - angular - poor porosity - p. to m. sorting - m. grained - salt & pepper appearance	
400' - 516	116'	SHALE - dk. grey - abd. micro muscovite - calcite coating - grading to silty - tr. marcasite - frags angular	
516 - 546	30'	COAL - shaley thru out - silty to argil - tr. marcasite	
546' - 550	4'	SHALE - m. dk. grey - abd. micro muscovite - tr. marcasite	
550 - 570	20'	SANDSTONE - lt. gy. - silica cmt. - m. grained - sub rounded - m. sorting - p. porosity	BASAL

ROTARY DRILL RECORD

Hole No.: 74 - 28

Property: Sage Creek Coal

Location: North Hill
17,856,672N
587,617E

Elevation: 4375'

Contractor: Becker Drilling Ltd.

Hole Size: 4 7/8"-5 5/8"

Rig No.: 4518

Date Commenced Drilling: October 23, 1974

Date Finished Drilling: October 29, 1974

Date Hole Completed: October 30, 1974

Logged By: Richard S. Blakeney

Date: October 30, 1974

Probed By: Roke Oil Enterprises

Date: October 29, 1974

Total Depth Drillers: 896

Depth of Overburden: 145

Total Depth Logger: 893

Water Level: Flowing

Bit Record

No.	Size	Make and Serial No.	R.P.M.	On	Off	Footage	Drilling Time

Surface Casing: 5'
Total Drilling Time: 135 hrs.
Total Down Time: ———
Total Footage Chargeable: 896'
Total Hourly Contact: ½ hr.

Standby Time for Logging: 4 hrs.
Other Standby Time: ———
Total Chargeable Standby Time: 4 hrs.
Actual Moving Time Between Holes: 10 hrs
Chargeable Moving Time " " : 8 hrs.
Quantity of Mud Used:

Remarks:- Caving of the coal in seams 2 + 5 make the seams appear thicker than their probable true thickness. This is particularly noticeable in seam 5. The thicknesses are adjusted in the summary on the basis of the Gamma Ray Neutron Log.

Probe Report:

891 - 0	Gamma/Neutron	Thru Double Walled Pipe
885 - 0	Sidewall Density	Open Hole
885 - 0	Caliper	Open Hole
875 - 26	E-Log	Open Hole

Coal Horizons

Coal Horizon	Drillers Picks	Interval	Log Picks	Interval
Seam #2	348-364	16	350 - 365	15'
Seam #4 Upper	408-450	42	410 - 452	42'
#4 Lower	Not recovered		480 - 494	14'
Seam #5	769-892	123	762 - 778 784 - 836	16') 52') 74'

INTERVAL	UNIT THICKNESS	DESCRIPTION
0 - 45	145	OVERBURDEN - mixture of various sedimentary rock types
145 - 230	85	SANDSTONE - medium grained - light to medium to dark grey - mainly angular to subangular - poorly sorted - variable chert content (2-10%) - siliceous cement - minor limonite staining near top
230 - 348	118	SHALE AND SILTSTONE INTERBEDDED SHALE - medium to dark grey - variably silty - thin coaly laminae - variably coaly SILTSTONE - dark grey - brownish highlights - siliceous - variably argillaceous
348 - 364	16	COAL - Seam 2 - mainly blocky with conchoidal fracture - in part extremely fine - in part shaly - minor interbedded coaly siltstones basally
364 - 394	30	SILTSTONE - coaly - dark grey - minor thin coal stringers - minor interbedded fine grained sandstones - minor interbedded coaly shale
394 - 408	14	SHALE - dark grey to black - variably silty - some interbedded dark grey siltstone
408 - 450	42	COAL - Seam 4 upper - in part shaly - in part very fine - minor interbeds of dark grey to black shale
450 - 580	130	SHALE - dark to medium grey - very slightly micaceous zones - silty - occasional thin interbeds of siltstone and fine grained sandstone - scattered coaly zones as at 485 (4 lower?)
580 - 620	40	SANDSTONE - light grey - fine grained - calcite cement - subangular to subrounded - poorly sorted - chert < 2% - some argillaceous

INTERVAL	UNIT THICKNESS	DESCRIPTION
620 - 700	80	SANDSTONE - light grey - medium grained - subrounded - moderately sorted - siliceous cement - porous - chert ≤ 2%
700 - 760	60	SHALE - medium grey - silty - in part pyritic - minor interbedded sand - slightly micaceous basally
760 - 834	74	COAL - Seam 5 - mainly blocky - in part very fine - in part shaly - minor interbedded shale - shale band from 777 to 781
834 - 896	62	The lithologies in this interval are obscured by caving of coal from Seam 5. At the top of the interval there is apparently a SANDSTONE - light grey - fine grained - siliceous cement - poorly sorted - subangular - chert ≤ 2% - some interbedded dark grey shale - perhaps 20' thick This is apparently underlain by SHALE - dark grey - coaly - silty - minor interbedded sandstone - becoming micaceous basally
896		Bottom of hole

ROTARY DRILL RECORD

Hole No.: 74-29

Property: Sage Creek Coal

Location: North Hill
17,855,838 N
584,301 E

Elevation: 5209'

Contractor: Becker Drilling Ltd.

Hole Size: 4-7/8" - 5-1/8"

Rig No.: 45-15

Date Commenced Drilling: October 11, 1974

Date Finished Drilling: October 12, 1974

Date Hole Completed: October 13, 1974

Logged By: Robert Talbot

Date: October 13, 1974

Probed By: Roke Oil Enterprises Ltd.

Date: October 12, 1974

Total Depth Drillers: 221'

Depth of Overburden: 70'

Total Depth Logger: 219'

Water Level: 169' or elev.5040'

Bit Record

No.	Size	Make and Serial No.	R.P.M.	On	Off	Footage	Drilling Time

Surface Casing: 6'
Total Drilling Time: 37 hrs.
Total Down Time: -
Total Footage Chargeable: 221'
Total Hourly Contact: 8½ hrs.

Standby Time for Logging: 1 hr.
Other Standby Time: -
Total Chargeable Standby Time: 1 hr.
Actual Moving Time Between Holes: 11 hr
Chargeable Moving Time " " : 9 hrs
Quantity of Mud Used:

Remarks:-

Probe Report:

219 - 0 Gamma/Neutron Thru Double-Walled Pipe

Coal Horizons

Coal Horizon	Drillers Picks		Log Picks	
Seam #5	118' - 174'	56'	130 - 143' 152 - 174' 180 - 188'	13') 22') 58' 8')

INTERVAL	UNIT THICKNESS	DESCRIPTION
0 - 70'	70'	OVERBURDEN
70 - 106'	36'	SANDSTONE - light grey - fractured - poor sorted - sub rounded to angular - silica cement - iron stained - micro-muscovite - tr marcasite
106 - 118'	12'	SHALE - light grey - micro-muscovite - tr ss frag - tr coal
118 - 174'	56'	COAL - 130 - 134 - abd shale - 144 - 150 - abd shale - 160 - 174 - abd shale
174 - 200'	26'	SANDSTONE (BASAL) - light grey - qtz > chert - silica cement - well sorted - fine to med grnd. - poor porosity - trace Fe st

RIO TINTO CANADIAN EXPLORATION LIMITED

ROTARY DRILL RECORD

Hole No.: 74-30

Property: SAGE CREEK COAL

Location: North Hill
17,855 862N
585,206E

Elevation: 4965'

Contractor: Becker Drilling Ltd.

Hole Size: 4-7/8" - 5-1/8"

Rig No.: 4515

Date Commenced Drilling: October 13, 1974

Date Finished Drilling: October 15, 1974

Date Hole Completed: October 19, 1974

Logged By: Jim Baker

Date: October 15, 1974

Probed By: Roke Oil Enterprises Ltd.

Date: October 15, 1974

Total Depth Drillers: 346'

Depth of Overburden: 40'

Total Depth Logger: 341'

Water Level: 30' or elev.4935'

Bit Record

No.	Size	Make and Serial No.	R.P.M.	On	Off	Footage	Drilling Time

Surface Casing: 10'
Total Drilling Time: 47 hrs.
Total Down Time: 8 hrs.
Total Footage Chargeable: 346'
Total Hourly Contact: 13½ hrs.

Standby Time for Logging: 2-1/4 hrs.
Other Standby Time: -
Total Chargeable Standby Time: 2½ hrs.
Actual Moving Time Between Holes: 6½ hrs
Chargeable Moving Time " " : 4½ "
Quantity of Mud Used:

Remarks:- Moved back on to hole Oct. 19 in an attempt to log with Density tool.

Probe Report:

339 - 0'	Gamma/Neutron	Thru Double-Walled Pipe
338 - 52'	E-Log	Open Hole

Coal Horizons

Coal Horizon	Drillers Picks		Log Picks	Interval
Seam #5	264-288	22'	254 - 266' 272 - 279'	12') 7')

INTERVAL	UNIT THICKNESS	DESCRIPTION Page 2
0 - 40'	40'	OVERBURDEN
40 - 100'	60'	SHALE - m gy - abd micro-muscovite - qtz frags & ss frags - tr marcasite - somewhat argil
100 - 264'	160'	SLT ST - SS - SHALE - Slt St & SS - m dk gy - qtz & chert - silica cmt - tr coal - tr calcite - Shale - mgy. - abd. micro-muscovite - argil. - chert frags - qtz & ss present
264 - 288	24'	COAL - top section abd shale present
288 - 345'	63'	SANDSTONE (BASAL) - m. dk. gy. - chert & qtz - fn-m. gr - silica cmt - m. sorting - sub rounded - tr marcasite

RIO TINTO CANADIAN EXPLORATION ...

ROTARY DRILL RECORD

Hole No.: 74 - 31

Property: Sage Creek Coal

Location: North Hill
17,855,833 N
586,825 E

Elevation: 4560'

Contractor: Becker Drilling Ltd.

Hole Size: 4-7/8" - 5-5/8"

Rig No.: 4520

Date Commenced Drilling: December 7, 1974

Date Finished Drilling: December 11, 1974

Date Hole Completed: December 11, 1974

Logged By: Jim Baker

Date: December 11, 1974

Probed By: Roke Oil Enterprises Ltd.

Date: December 11, 1974

Total Depth Drillers: 790'

Depth of Overburden: 30'

Total Depth Logger: 789'

Water Level: Full (Mud)

Bit Record

No.	Size	Make and Serial No.	R.P.M.	On	Off	Footage	Drilling Time

Surface Casing: 16'
Total Drilling Time: 118 hrs.
Total Down Time: 5 hrs.
Total Footage Chargeable: 790'
Total Hourly Contact: -

Standby Time for Logging: 4 hrs.
Other Standby Time: -
Total Chargeable Standby Time: 4 hrs.
Actual Moving Time Between Holes: 10hrs
Chargeable Moving Time " " : 8 "
Quantity of Mud Used:

Remarks:-

Probe Report:

780 - 0 ..... Gamma/Neutron .....Thru Double Walled Pipe

Coal Horizons

Coal Horizon	Drillers Picks		Log Picks	
Seam #2	275 - 293	18'	264 - 281	17'
Seam #4 Upper	365 - 399	34'	351 - 380	29'
Lower	413 - 449	36'	401 - 432	31'
Seam #5	701 - 752 (710 - 730 Shale)	51'	684 - 701 708 - 737	17') 29')

INTERVAL	UNIT THICKNESS	DESCRIPTION Page 2
0 - 30	30'	OVERBURDEN - Very coarse granules - Clay & gravel
30 - 150	120'	SHALE - Med. Gray - Abd. micro-muscovite - Somewhat silty - Gravel present throughout
150 - 200	50'	SANDSTONE - Med-dark gry - Med grained - Chert & qtz - Silica cmt. - P sorted - Sub angular - Tr pyrite, coal & shale
200 - 275	75'	SHALE - Med gray - Abd. micro-muscovite - Abd. sloughed SS in top of section
275 - 365	18'	COAL - Seam #2
293 - 365	72'	SHALE - Med gray - Somewhat silty - Moderate micro-muscovite - Tr. coal
365 - 449	84'	COAL Seam #4 - 365 - 399 Upper - (399 - 413 Shale) - 413 - 449 Lower
449 - 580	131'	SHALE - Med gray - Abd micro-muscovote - Tr coal
580 - 640	60'	SANDSTONE - Med gray - Med-crs grained - Qtz & chert - Sub angular - Poorly sorted - Abd slt. stone - tr. coal

INTERVAL	UNIT THICKNESS	DESCRIPTION
640 - 701	61'	SHALE - Med gray - Abd micro-muscovite - Slightly argil - Coaly throughout
701 - 752	51'	COAL - Seam #5 - Argil throughout - Abd sltst & shale present - Shale band (710-730')
752 - 780	28'	SANDSTONE (Basal) - Light gray - Fn grained - Silica cmt - Chert & qtz - Sub rounded - Poor porosity - 30% shale & coal present (sloughing)

ROTARY DRILL RECORD

Hole No.: 74- 32

Property: Sage Creek Coal

Location: North Hill
17,855,863 N
587,602 E

Elevation: 4407'

Contractor: Becker Drilling Ltd.

Hole Size: 4-7/8" = 5-5/8"

Rig No.: 4520

Date Commenced Drilling: November 29, 1974

Date Finished Drilling: December 6, 1974

Date Hole Completed: December 6, 1974

Logged By: Jim Baker

Date: December 6, 1974

Probed By: Roke Oil Enterprises Ltd.

Date: December 6, 1974

Total Depth Drillers: 983

Depth of Overburden: Gravel to 260'

Total Depth Logger: 980

Water Level: Full

Bit Record

No.	Size	Make and Serial No.	R.P.M.	On	Off	Footage	Drilling Time

Surface Casing: $"
Total Drilling Time: 176 hrs.
Total Down Time: 4 hrs.
Total Footage Chargeable: 983'
Total Hourly Contact: -

Standby Time for Logging: 3 hrs.
Other Standby Time: 1 hr.
Total Chargeable Standby Time: 4 hrs.
Actual Moving Time Between Holes: 5½ hrs
Chargeable Moving Time " " : 3½ "
Quantity of Mud Used:

Remarks:-

Gravels + broken rock to 260 ' Fault @ 868' displacing 140'-150' of strata

Probe Report:

978 - 0 .....Gamma/Neutron.....Thru Double Walled Pipe
971 - 0 .....Sidewall Densilog.....Open Hole
970 - 0 .....Caliper.....Open Hole
960 - 0 .....E-Log.....Open Hole

Coal Horizons

Coal Horizon	Drillers Picks		Log Picks	
Seam #2	Missed		658 - 672	14'
Seam #4 Upper	757 - 791	34'	745 - 790	45'
Lower	820 - 825	5'	806 - 819	13'
Seam #5	930 - 954	24'	920 - 942	22'

INTERVAL	UNIT THICKNESS	DESCRIPTION
0 - 260	260'	GRAVEL - Sandstone - Chert frags - Siltstone - Shale - Limestone scattered thru top 100' of section. - Frags generally as granules - Somewhat rounded - SS stringer (170' - 190')
260 - 350	90'	CONGLOMERATE - Lt. brown - med. gray - Chert frags. - Coarse - angular
350 - 530	180'	GRAVEL - SS, Sltst, Sh, Chert, etc. - Unconsolidated mixture - Several SS stringers - Last 20' shale
530 - 590	60'	SANDSTONE - V. fn - fn grained - Med - lt gray - Chert & qtz - Silica cmt - M sorting - Sub rounded - Grades to cherty & crs grained
590 - 755	165'	SHALE - Med - dark gray - Abd micro-muscovite - Top of section abd, caving due to gravel
757 - 791	34'	COAL #4 Upper
791 - 820	29'	SHALE - Med-dk gray - Mod micro-muscovite
820 - 825	5'	COAL #4 Lower
825 - 930	105'	SHALE - Med gray - Moderate micro-muscovite
930 - 954	24'	COAL #5 - Argil - Tr marcasite - Shaley throughout
954 - 980	66'	SANDSTONE "Basal" - White-lt gray - Fn-med grained - Silica cmt - Qtz rich - Well sorted - Rounded - Abd sloughed coal from Seam #5 present

ROTARY DRILL RECORD

Hole No.: 74 - 33

Property: Sage Creek Coal

Location: North Hill
17,855,431N
585,998E

Elevation: 4798'

Contractor: Becker Drilling Ltd.

Hole Size: 5 1/8" - 5 5/8"

Rig No.: 45 - 20

Date Commenced Drilling: Nov. 24, 1974

Date Finished Drilling: Nov. 28, 1974

Date Hole Completed: Nov. 29, 1974

Logged By: Jim Baker

Date: Nov. 29, 1974

Probed By: Roke Oil Enterprises Ltd.

Date: Nov. 29, 1974

Total Depth Drillers: 660

Depth of Overburden: 5'

Total Depth Logger: 660

Water Level: 46' or elev. 4752

Bit Record

No.	Size	Make and Serial No.	R.P.M.	On	Off	Footage	Drilling Time

Surface Casing: 7'
Total Drilling Time: 112 hrs.
Total Down Time: 2 hrs.
Total Footage Chargeable: 660'
Total Hourly Contact: ———

Standby Time for Logging: 6 hrs.
Other Standby Time: 2 hrs.
Total Chargeable Standby Time: 8 hrs.
Actual Moving Time Between Holes: 6 hrs
Chargeable Moving Time " " : 4 hrs
Quantity of Mud Used:

Remarks:-

Probe Report:

648 - 0	Gamma/Neutron	Thru Double Walled Pipe
654 - 0	Sidewall Densilog	Open Hole
654 - 0	Caliper	Open Hole
652 - 60	E - Log	Open Hole

Coal Horizons

Coal Horizon	Drillers Picks		Log Picks		
Seam #2	166-182	16'	162'-177'	15'	
Seam #4 upper	263-281	18'	257'-276'	19'	
lower	312-318	6'	305'-316'	11'	
Seam #5	572-630	58'	567-592	25')	
			597-603	6')	63'
			607-614	7')	
			620-630	10')	

INTERVAL	UNIT THICKNESS	HOLE 74-33 DESCRIPTION	PAGE 1
0 - 150'	150'	SANDSTONE - med. - crs.grained - med. grey - chert & qtz. - silica cmt. - sub-angular - angular - p. sorted - tr. marcasite - minor hematite stain - 80' - 120' siltstone stringers	
150' - 166'	16'	SHALE - med. grey - abd. micro muscovite	
166' - 182'	16'	COAL Seam #2 - black - shiney - brittle	
182' - 263'	81'	SHALE - med. grey - micro muscovite present - somewhat silty	
263' - 281'	18'	COAL - seam #4 upper	
281' - 312'	31'	SHALE - med. grey - abd. micro muscovite	
312' - 318'	6'	COAL - seam #4 lower	
318' - 400'	82'	SHALE - med. gray - abd. micro muscovite	
400' - 572'	172'	SANDSTONE - med. gray - med. - crs grained - chert & qtz. - silica cement - p. sorted - angular - sub angular - * siltstone towards top of this section - * shaley towards bottom	
572' - 630'	58'	COAL - Seam #5 - argil thru out	
630' - 660'	30'	SANDSTONE "Basal" - white - lt. grey - med. grained - qtz. rich - silica cmt. - w. sorted - w. rounded	

ROTARY DRILL RECORD

Hole No.: 74 - 34

Property: Sage Creek Coal

Location: North Hill
17,855,049N
584,369E

Elevation: 5320'

Contractor: Becker Drilling Ltd.

Hole Size: 4 7/8" - 5 1/8"

Rig No.: 4515

Date Commenced Drilling: Sept. 25, 1974

Date Finished Drilling: Sept. 26, 1974

Date Hole Completed: Sept. 28, 1974

Logged By: Jim Baker

Date: Sept. 27, 1974

Probed By: Roke Oil Enterprises Ltd.

Date: Sept. 26, 1974

Total Depth Drillers: 422'

Depth of Overburden: 5'

Total Depth Logger: 422

Water Level: 197'or elev. 5123

Bit Record

No.	Size	Make and Serial No.	R.P.M.	On	Off	Footage	Drilling Time

Surface Casing: 20'
Total Drilling Time: 34 hrs.
Total Down Time: ——
Total Footage Chargeable: 422'
Total Hourly Contact: 58 hrs.

Standby Time for Logging: 2½ hrs.
Other Standby Time: ——
Total Chargeable Standby Time: 2½ hrs.
Actual Moving Time Between Holes: 4½ hrs
Chargeable Moving Time " " : 3½ hrs
Quantity of Mud Used:

Remarks:-
58 hrs. spent fishing for Density Probe

Probe Report:

421 - 0 Gamma/Neutron Thru Double Walled Pipe

Coal Horizons

Coal Horizon	Drillers Picks		Log Picks	
Seam #4 Upper	90' - 122	32'	90' - 121'	31'
#4 Lower	140 - 156	16'	141 - 153'	12'
Seam #5	350' - 390'	40'	354 - 372	18') 36'
			377 - 390	13')

INTERVAL	UNIT THICKNESS	HOLE 74-34 DESCRIPTION PAGE 1
0' - 90'	90'	SHALE - lt. gy. - micro muscovite - silty in places - mod-extreme Fe.st. present throughout
90' - 156'	66'	COAL Seam #4 - shale str. 122-40
156' - 235'	79'	SHALE - grading to silty throughout - abd. micro muscovite
235' - 290'	55'	SANDSTONE - fn. m. gy. - lt. gy. - sub-angular - silica cement - chert & qtz. - poorly sorted - abd. slt. st. - tr. calcite
290' - 350'	60'	SLT.ST. & SHALE - lt. gy. - abd. micro muscovite - argil - tr. coal - tr. marcasite
350' - 390'	40'	COAL - shaley parts throughout - Fe. st. present
394'- 422'	28'	SANDSTONE - dk. gy. - m. gr. - chert & qtz. - sub angular - silica cmt. - tr. coal & calcite - more qtz. than chert

ROTARY DRILL RECORD

Hole No.: 74 - 35

Property: Sage Creek Coal

Location: North Hill
17,855,031N
587,614E

Elevation: 4449'

Contractor: Becker Drilling Ltd.

Hole Size: 4 7/8" - 5 5/8"

Rig No.: 4520

Date Commenced Drilling: Dec. 12, 1974

Date Finished Drilling: Dec. 20, 1974

Date Hole Completed: Dec. 20, 1974

Logged By: Jim Baker

Date: Dec. 20, 1974

Probed By: Roke Oil Enterprises

Date: Dec. 20, 1974

Total Depth Drillers: 1209

Depth of Overburden: 60'

Total Depth Logger: 1207

Water Level: Flowing

Bit Record

No.	Size	Make and Serial No.	R.P.M.	On	Off	Footage	Drilling Time

Surface Casing: 16'
Total Drilling Time: 195 hrs.
Total Down Time: 30 hrs.
Total Footage Chargeable: 1209
Total Hourly Contact: ———

Standby Time for Logging: 1 1/2 hrs.
Other Standby Time: ———
Total Chargeable Standby Time: 1½ hrs.
Actual Moving Time Between Holes: 4 hrs
Chargeable Moving Time " " : 2 hrs
Quantity of Mud Used:

Remarks:-

60' gravels

Probe Report:

1205 - 0 Gamma/Neutron Thru Double Walled Pipe

Coal Horizons

Coal Horizon	Drillers Picks		Log Picks		
Seam #2	578 - 596	18'	571 - 587	16'	
Seam #4	736 - 768	32'	729 - 761	32'	
	810 - 824	14'	801 - 814	13'	
Seam #5	1117 - 1160	43'	1111 - 1128	17')	40'
			1139 - 1151	12')	

INTERVAL	UNIT THICKNESS	HOLE 74-35 DESCRIPTION PAGE 1
0 - 60	60'	OVERBURDEN - gravel
60 - 260	200'	SANDSTONE - lt. brown - fn. grained - chert & qtz. - silica cement - sub rounded - p. sorted
260 - 350	90'	SHALE - dark grey - abd. micro muscovite - somewhat silty - qtzites present
350 - 530	180'	SANDSTONE - lt. brown - lt. grey - fn. - med. grained - qtz. & chert - silica cement - m. sorting - sub-rounded - fair porosity - abd. fe.st.
530 - 578	45'	SHALE - med. dark grey - abd. micro muscovite
578 - 596	18'	COAL Seam #2
596 - 736	140'	SHALE - med. dark grey - moderate micro muscovite
736 - 824	88'	COAL - Seam #4 - Upper 810-824 (14) - Lower 736-768 (32)
824 - 860	36'	SHALE - med. grey - silty - abd. micro muscovite
860 - 1040	180'	SANDSTONE - fn. - med. grained - lt. grey - chert & qtz. - silica cement - med. sorting; sub rounded - 20% shale - shale stringers thru out

INTERVAL	UNIT THICKNESS	Hole 74-35 DESCRIPTION
1040 - 1160	43	COAL - Seam #5
1160 - 1206	46'	SANDSTONE Basal - fn. m. grained - lt. gray - qtz. silica cement - w. sorted - sub-rounded

ROTARY DRILL RECORD

Hole No.: 74 - 36

Property: Sage Creek Coal

Location: North Hill
17,854,249N
583,688E

Elevation: 5284 '

Contractor: Becker Drilling Ltd.

Hole Size: 4 7/8"

Rig No.: 4515

Date Commenced Drilling: Sept. 28, 1974

Date Finished Drilling: Sept. 29, 1974

Date Hole Completed: Sept. 29, 1974

Logged By: Jim Baker

Date: Sept. 29, 1974

Probed By: Roke Oil Enterprises Ltd.

Date: Sept. 29, 1974

Total Depth Drillers: 257'

Depth of Overburden: 15'

Total Depth Logger: 252'

Water Level: 20' or elev.5264'

Bit Record

No.	Size	Make and Serial No.	R.P.M.	On	Off	Footage	Drilling Time

Surface Casing: 10'
Total Drilling Time: 23 hrs.
Total Down Time: 4 hrs.
Total Footage Chargeable: 257'
Total Hourly Contact: 3 hrs.

Standby Time for Logging: 1 hr.
Other Standby Time: ——
Total Chargeable Standby Time: 1 hr.
Actual Moving Time Between Holes: 2 hrs.
Chargeable Moving Time " " : 1 hr.
Quantity of Mud Used:

Remarks:-

Probe Report:

250 - 0	Gamma/Neutron	Thru Double Walled Pipe
244 - 0	Sidewall Densilog	Open Hole
244 - 0	Caliper	Open Hole

Coal Horizons

Coal Horizon	Drillers Picks		Log Picks	
Seam # 5	191 - 213	22'	188 - 211	23 '

INTERVAL	UNIT THICKNESS	74-36 DESCRIPTION
0 - 15'	15'	OVERBURDEN
15 - 180'	165'	INTERBEDDED SLT.ST. & SANDSTONE SS - lt. m. gy. - v. fn. gr. - m. gr. - chert & qtz. - silica cmt. - sub-angular - sub rd. - p-m. sorting SLT. ST. - lt.-m. gy. - abd. micro muscovite - argil.
180' - 191'	11'	SHALE - dk.-my. gy. - micro muscovite
191' - 213'	22'	COAL - dirty (mud & clay)
213' - 260'	47'	SANDSTONE - fn.-m. gr. - qtz. & chert - sub. rd. - sub. ang. - silica cmt. - m. sort. - m. gy. - p. porosity

ROTARY DRILL RECORD

Hole No.: 74 - 37

Property: Sage Creek Coal

Location: North Hill
17,854,242N
586,037E

Elevation: 4762' ±

Contractor: Becker Drilling Ltd.

Hole Size: 6 3/4"

Rig No.: 4518

Date Commenced Drilling: Oct. 29, 1974

Date Finished Drilling: Nov. 7, 1974

Date Hole Completed: Nov. 7, 1974

Logged By: Richard S. Blakeney

Date: Nov. 8, 1974

Probed By: Roke Oil Enterprises

Date: Nov. 7, 1974

Total Depth Drillers: 828

Depth of Overburden: 20 ft.

Total Depth Logger: 813

Water Level: 36' or elev. 4726'

Bit Record

No.	Size	Make and Serial No.	R.P.M.	On	Off	Footage	Drilling Time

Surface Casing: 20'
Total Drilling Time: 235 hrs.
Total Down Time: ——
Total Footage Chargeable: 97'
Total Hourly Contact: 221 hrs.

Standby Time for Logging: 4½ hrs.
Other Standby Time: ——
Total Chargeable Standby Time: 4½ hrs.
Actual Moving Time Between Holes: 8 hrs
Chargeable Moving Time " " : 6 hrs
Quantity of Mud Used:

Remarks:- Coal horizons cored.
Stratigraphic thickening between Seams 4 + 5 associated with splitting of horizon 5 into 2 Seams -see hole 74-42

Probe Report:

811 - 0	Gamma/Neutron	Open Hole
810 - 0	Sidewall Densilog	Open Hole
810 - 0	Caliper	Open Hole
810 - 64	E - Log	Open Hole

Coal Horizons

Coal Horizon	Drillers Picks	Interval	Log Picks	Interval
Seam #2	166 - 184	18	166 - 181	15'
Seam #4 upper	337 - 362	25	324 - 361	37
Seam #4 lower	395 - 414.5	19.5	387 - 408	21
Seam #5	786 - 799	13	761 - 787	26

INTERVAL	UNIT THICKNESS	Hole 74-37 DESCRIPTION PAGE 1
0 - 20	20	Overburden and weathered upper portion of bedrock
20 - 30	10	Weathered bedrock consisting of dark grey, silty, slightly micaceous shale and light grey fine to medium grained, sub-angular to sub-rounded, poorly sorted siliceous sandstone.
30 - 92	62	SANDSTONE - dark grey - medium grained - siliceous cement - variable limonite and hematite staining - poorly sorted - angular to sub-angular - thin, coaly laminae - variable chert content
92 - 166	74	SILTSTONE - some interbedded dark grey coaly shales - medium grey - somewhat sandy - thin coaly laminae - variable grain size - coal stringers basally
166 - 184	28	COAL - Seam 2 - blocky - friable - pyritic - in part very fine - in part shaly - interbeds of dark grey coaly shale
184 - 210	26	SHALE - dark grey - coaly - thin coal stringers - silty - grading to siltstone basally
210 - 245	35	SILTSTONE - dark grey - hard - not limy - calcite on fracture surfaces
245 - 290	45	SANDSTONE - fine to coarse grained - grain size increases downward - medium grey - calcite cement - poorly sorted - mainly subangular - chert 2-5%
290 - 322	32	SHALE - dark grey - thin coaly laminae - very slightly micaceous - somewhat silty

INTERVAL	UNIT THICKNESS	74-37 DESCRIPTION PAGE 2
322 - 362	30	COAL - Seam 4 upper - shaly to blocky - some thin mud bands (2" - 3") - interbedded soft muddy shales - mainly very fine - friable
362 - 387	25	SHALE - brown grey to grey - in part silty - thin coal stringers - some interbedded limy siltstone - hard to soft
387 - 410	23	COAL - Seam 4 lower - some interbedded hard to soft shales - mainly very fine - in part shaly - in part blocky
410 - 560	150	SHALE - dark to medium grey - some interbedded siltstone - in part silty - possibly in part slightly micaceous - occasional 10 foot sandstone lenses
560 - 590	30	SANDSTONE - some siltstone at top - fine grained - some coarse angular interbeds - slightly calcareous - medium to dark grey - subangular mainly - moderate sorting
590 - 710	120	SHALE - medium grey - silty - with interbedded thin siltstones - thin coal stringers
710 - 762	52	SILTSTONE - medium grey - calcareous - with interbedded shales & sandstones - thin coal stringers basally - in part sandy
762 - 783	21	COAL - Seam 5 - soft - occasional mud band - mainly shaly - in part very fine - in part blocky - minor pyrite - thin shale stringers
783 - 814	31	SANDSTONE - some shale at top - subrounded - well sorted - very petroliferous toward top - medium to dark grey - fine to medium grained - coaly toward top

ROTARY DRILL RECORD

Hole No.: 74-39

Property: Sage Creek Coal

Location: North Hill
17,854,250 N
587,603 E

Elevation: 4410' asl.

Contractor: Becker Drills Ltd.

Hole Size: 4 7/8"-5 5/8"

Rig No.: 45-18

Date Commenced Drilling: November 29,1974

Date Finished Drilling: December 4,1974

Date Hole Completed: Hole Abandoned December 6,1974

Logged By: R. Talbot

Date: December 4,1974

Probed By: Roke Oil Enterprises Ltd.

Date: December 6,1974

Total Depth Drillers: 646'

Depth of Overburden: 200'

Total Depth Logger: 626'

Water Level: Flowing

Bit Record

No.	Size	Make and Serial No.	R.P.M.	On	Off	Footage	Drilling Time

Surface Casing: 12'
Total Drilling Time: 84 hrs.
Total Down Time: 88 hrs.
Total Footage Chargeable: 646'
Total Hourly Contact: 15 hrs.

Standby Time for Logging: 1 1/2 hrs.
Other Standby Time:
Total Chargeable Standby Time: 1/2 hrs.
Actual Moving Time Between Holes: 14 1/2 hrs
Chargeable Moving Time " 12 1/2hr
Quantity of Mud Used:

Remarks:-

Pipe stuck in hole- causing most of down time
'Extreme artisian water pressure. Bad down hole sloughing.

Probe Report:

624-0 .....Gamma Ray/Newton .....Thru Dual Wall Pipe

265 .....Caliper .....Open Hole

Coal Horizons

Coal Horizon	Drillers Picks		Log Picks	
Seam	556-570 (V. P. recovery)	14'	556-574	18 '

INTERVAL	UNIT THICKNESS	DESCRIPTION
0 - 200	200'	Overburden -glacial till and clay near surface -gravels and broken and disaggregated rocks -mixture of sedimentary lithologies -ss., qtzt., chert., -minor ls. & calcite -In part abnd. Fe. Stn.
200-220	20	Sandstone -lt. brn. -silica cmt. -f. -m. gr. -A-a gr. -p. sort. -med. to gd. poros. - some chert frags. -tr. Fe. stn.
220-290	70	Conglomerate or Conglomeratic SS - chert pbl. congl. - qtzt., chert, s. s. frags. - ss. matrix - wthrd appearance - same Fe. stn. - some ls. frags - broken
290-330	40	Sandstone -lt.. -m. brn. - silica cmt., - p. sort; p. poros - Fe stn. - sub angular to sub rounded frags. - chert, sh, sltst, qtzt frags. - tr. ls. frags. - tr. coal @ 320'
330-350	20	Conglomerate or Conglomeratic SS -chert, qtz ., ss frags. - gr. sh + coal
250 - 370	20'	Shale, Siltstone & ss - m. gy. - in part wthrd; some Fe stn. -some chert & ls. frags. - tr. coal
370-480	110'	Sandstone - lt. gy., wthrd., some Fe, stn. - sltst & sh. frags. - chert frags - conglomeratic in part - badly caved

INTERVAL	UNIT THICKNESS	DESCRIPTION
480 - 500	20'	Shale & Sandstone - 60% shale frags. -ss. & chert frags. -Fe s.n.
500-540	40'	Sandstone -m. gy, -m. gr. -silica cmt. -p. sort. -tr coal & sh. - appears gravelly for bottom 20 feet
540 -556	16	Shale -m. gy. -abnd. micro-muscovite. -30% ss & chert frags. - tr. coal
556-570	14	Coal Horizon 2 -shaly -cavings of Fe stn ss & sltst -same chert frags.
570 -630	60	Shale & Siltstone -m. gy. -abnd. micro-muscovite -ss & coal frags -mixture of lithologies -badly caved.
630-645	15	Sandstone -60% ss frags. -m. gy; p. sort., -f-m gr. -chert & qtzt frags. -some Fe stn. -Tr. coal ptcls.
646		Hole Abandoned

RIO TINTO CANADIAN EXPLORATION LIMITED

ROTARY DRILL RECORD

Hole No.: 74-40 Property: Sage Creek Coal

Location: North Hill
17,853,263 N
583,870 E Elevation: 5192'

Contractor: Becker Drilling Ltd. Hole Size: 5-1/8"

Rig No.: 4515

Date Commenced Drilling: September 23, 1974

Date Finished Drilling: September 24, 1974

Date Hole Completed: September 24, 1974

Logged By: Jim Baker Date: September 24, 1974

Probed By: Roke Oil Enterprises Ltd. Date: September 24, 1974

Total Depth Drillers: 351' Depth of Overburden: 20'

Total Depth Logger: 342' Water Level: 105'

Bit Record

No.	Size	Make and Serial No.	R.P.M.	On	Off	Footage	Drilling Time

Surface Casing: 20'
Total Drilling Time: 30hrs.
Total Down Time: -
Total Footage Chargeable: 351'
Total Hourly Contact: 9 hrs

Standby Time for Logging: 3½ hrs.
Other Standby Time: -
Total Chargeable Standby Time: 3½ hrs.
Actual Moving Time Between Holes: 3½hrs
Chargeable Moving Time " " : 2½ "
Quantity of Mud Used:

Remarks:-

Probe Report:

340- 0 .....Gamma/Neutron .....Thru Double Walled Pipe
338- 0 .....Sidewall Densilog .....Open Hole
338- 0 .....Caliper.....Open Hole
340-136 .....E-log..... Open Hole

Coal Horizons

Coal Horizon	Drillers Picks		Log Picks	
Seam #4 Upper	22 - 54	32'	22 - 49	27'
Lower	65 - 86	21'	68 - 86	18'
Seam #5	270 -330	60'	276 -300	24')
			306 -329	23')

INTERVAL	UNIT THICKNESS	DESCRIPTION
0 - 22	22'	NO RECOVERY
22 - 86	64'	COAL Seam #4 - Bl, shiney, m hard - 54' - 65' Sh stringer
86 - 205	119'	SHALE - Lt - m gy - Argil. - Abd. micro-muscovite - V. dirty; in places clay - SS stringers @ - ≈100' - 195' - Abd. slt. st. present from 185' - 205'
205 - 270	65'	SANDSTONE - Fn-m gr., wh-lt gy - Silica cmt - Qtz & chert - Sub angular - P-m sorting - Argil. - Sh. str. 230 - 245
270 - 330	60'	COAL #5 Seam - Black, shiney - Tr marcasite - Becomes shaly @ 300'-310'
330 - 350	20'	SS - M-dk gy - Qtz & chert (mainly qtz) silica cement - Sub rounded - rounded, m. gr - Tr coal & sh

ROTARY DRILL RECORD

Hole No.: 74-41

Property: Sage Creek Coal

Location: North Hill
17,853,538 N
585,221 E

Elevation: 5132'

Contractor: Becker Drilling Ltd.

Hole Size: 5-1/8" - 5-5/8"

Rig No.: 45-20

Date Commenced Drilling: November 10, 1974

Date Finished Drilling: November 16, 1974

Date Hole Completed: November 16, 1974

Logged By: Jim Baker

Date: November 16, 1974

Probed By: Roke Oil Enterprises Ltd.

Date: November 16, 1974

Total Depth Drillers: 940'

Depth of Overburden: < 5'

Total Depth Logger: 932'

Water Level: 200 '

Bit Record

No.	Size	Make and Serial No.	R.P.M.	On	Off	Footage	Drilling Time

Surface Casing: 4'
Total Drilling Time: 140 hrs.
Total Down Time: 4 hrs.
Total Footage Chargeable: 940'
Total Hourly Contact: 1 hr.

Standby Time for Logging: 3 hrs.
Other Standby Time: 7½ hrs.
Total Chargeable Standby Time: 10½ hrs.
Actual Moving Time Between Holes: 6½ hrs
Chargeable Moving Time " " : 4½
Quantity of Mud Used:

Remarks:-

Development of Seam 1 Thickening of coal horizon 2.

Probe Report:

930 - 0 ..... Gamma Ray ..... Thru Double Walled Pipe
920 - 0 ..... Gamma/Neutron ..... Open Hole
930 - 0 ..... Sidewall Densilog ..... Open Hole
930 - 0 ..... Caliper ..... Open Hole
930 - 0 ..... E-Log ..... Open Hole

Coal Horizons

Coal Horizon	Drillers Picks		Log Picks	
Seam #2	400 - 439	39'	398 - 434	36'
Seam #4	570 - 590	20'	568 - 582	14'
	610 - 620	10'	605 - 624	19'
Seam #5	840 - 910	70'	836 - 860	
			873 - 904	68 '

INTERVAL	UNIT THICKNESS	DESCRIPTION
0 - 90	90'	SANDSTONE - M-crs. grained - Qtz, rich & chert - Lt. brown, extreme Fe stain - P. sorted - Sub angular - angular - Tr. rotten feldspar throughout - Tr. conglomeratc
90 - 160	70'	SHALE - Dk gray - Micro-muscovite present - Clay band from 110 - 130'
160 - 400	240'	SANDSTONE - Fn-med grained - Qtz rich & chert - Lt gray-lt brown - P. sorted - Silica cement - Sub ang. - ang - Tr. shale - Abd. limonite stain - 270 - 310' shale strngr.
400 - 439	39'	COAL Seam #2 - Shaley
439 - 570	131'	SILTSTONE - Shaley towards top - Qtz & chert - Silica cement
570 - 620	50'	COAL Seam #4 - 590 - 610 - Shale
620 - 840	220'	SILTSTONE - interbedded Slt St & SS throughout - Minor shale bands throughout - Sltst contains qtz & chert cemented in silica
840 - 910	70'	COAL Seam 5 - V argil throughout
910 - 940	30'	SANDSTONE (Basal SS) - White-lt grey - Qtz rich (minor chert) - Silica cement - Med grained - W sorted - Abd shale & coal present

ROTARY DRILL RECORD

Hole No.: 74-42

Property: Sage Creek Coal

Location: North Hill
17,853,475N
585,976E

Elevation: 4773'

Contractor: Becker Drilling Ltd.

Hole Size: 5 1/8" - 5 5/8"

Rig No.: 4518

Date Commenced Drilling: Nov. 7, 1974

Date Finished Drilling: Nov. 14, 1974

Date Hole Completed: Nov. 14, 1974

Logged By: Richard S. Blakeney

Date: Nov. 14, 1974

Probed By: Roke Oil Enterprises

Date: Nov. 14, 1974

Total Depth Drillers: 897

Depth of Overburden: 5

Total Depth Logger: 893

Water Level: Full

Bit Record

No.	Size	Make and Serial No.	R.P.M.	On	Off	Footage	Drilling Time

Surface Casing: 3'
Total Drilling Time: 167 hrs.
Total Down Time: ———
Total Footage Chargeable: 897'
Total Hourly Contact: 9½ hrs.

Standby Time for Logging: 7 hrs.
Other Standby Time: 3 hrs.
Total Chargeable Standby Time: 10 hrs.
Actual Moving Time Between Holes: 10 hr.
Chargeable Moving Time " " : 8 hrs.
Quantity of Mud Used:

Remarks:- Prble fault @ 250 '
Approx. 120 ' strata displaced
Seam 4 thinned to 4'
Horizon 5 split into 2 seams

Probe Report:

890-0	Gamma Ray	Thru Double Walled Pipe
865-0	Gamma/Neutron	Open Hole
888-0	Sidewall Densilog	Open Hole
888-0	Caliper	Open Hole
888-28	E-Log	Open Hole

Coal Horizons

Coal Horizon	Drillers Picks	Interval	Log Picks	Interval
Seam #2	290.6 - 311	20.4	290 - 311	21'
Seam #4 Upper	465 - 485	20	459 - 483	24'
Seam #4 Lower	———	———	516 - 520	4'
Seam #4 Upper	744 - 778	34	735 - 754	19'
Seam #5 Lower	835 - 849	14	827 - 838	11'

INTERVAL	UNIT THICKNESS	HOLE 74-42 DESCRIPTION	PAGE 1
0 - 5	5	OVERBURDEN	
5 - 20	15	SANDSTONE - grey to brownish - medium grained to conglomeratic - chert ≤ 5-10% - some iron staining - poorly to well sorted - angular to sub-rounded - siliceous cement - some argillaceous matrix	
20 - 91	71	SANDSTONE - coarse grained - light greyish brown - angular to sub-angular - < 2% chert - poorly sorted - limonitic - siliceous cement - interbedded with chert pebble conglomerate at the top - becoming predominantly conglomerate with interbedded sandstone basally - chert pebbles are dark grey, well rounded	
91 - 117	28	SANDSTONE - medium grey - fine to medium grained - slightly porous - siliceous cement - sub-angular - chert 2-5% - poorly sorted - minor pyrite - interbedded with siltstone basally SILTSTONE - medium grey - sandy - siliceous - minor coal specks	
117 - 124	7	COAL - blocky - conchoidal fracture - with sandstone and siltstone interbedded	
124 - 210	86	SILTSTONE AND SHALE INTERBEDDED SILTSTONE - medium grey - mainly limy - soft - argillaceous to sandy SHALE - dark grey to black - silty - coaly - thin coal laminae - occasional coal stringers - pyritic	

INTERVAL	UNIT THICKNESS	DESCRIPTION
210 - 260	50	SANDSTONE - medium grey, fine to medium grained - moderately sorted, subangular, calcite cement chert 2-5% with minor interbedded medium grey, silty shale basally
At 249 feet water inflow approximately 39 gallons per minute		
260 - 280	20	SILTSTONE - medium grey - argillaceous - limy - with minor interbedded sandstone
At 274 feet water inflow approximately 36 gallons per minute		
280 - 288	8	SHALE - dark grey - coaly - thin coal laminae - plant fragments
288 - 310	22	COAL - Seam 4 - blocky to shaly - pyritic - some interbedded dark grey coaly shale
310 - 330	20	SHALE - medium to dark grey - silty - in part slightly micaceous - pyritic - coaly at the top
330 - 360	30	SILTSTONE - dark grey - limy - sandy - some interbedded sandstone
360 - 401	41	SANDSTONE - medium to coarse grained - medium grey - calcite cement - poorly to moderately sorted - subangular - minor interbedded siltstone at the top - chert ≈2-10%
401 - 458	57	SHALE - medium to dark grey - variably silty - some thin coaly laminae - in part pyritic - not calcareous
458 - 482	24	COAL- Seam 4 Upper - mainly blocky - in part shaly - minor pyrite - some silty coaly shale basally

INTERVAL	UNIT THICKNESS	74-42 DESCRIPTION
482 - 640	155	SHALE - mainly medium grey - in part calcareous - variably silty - some thin interbeds of siltstone and sandstone - occasional thin coal stringers
640 - 660	20	SANDSTONE - medium grey - very fine - calcite cement - subangular - poorly sorted - chert ~1%
660 - 735	75	INTERBEDDED SHALE AND SILTSTONE SHALE - medium grey - silty - minor coal basally SILTSTONE - medium grey - argillaceous - in part calcareous
735 - 754	19	COAL - Seam 5 upper - mainly blocky - in part very fine - in part shaly - minor interbedded shale
754 - 820	66	SILTSTONE - medium grey - calcareous - argillaceous - some interbedded dark grey shale - some interbedded very fine grained sandstone
820 - 838	18	COAL - Seam 5 lower - some shale toward top - mainly blocky - in part shaly - in part very fine
838 - 895	57	SANDSTONE - medium grey - siliceous - becoming calcareous basally - occasional kaolinized feldspar - some interbedded shale - fine to medium grained - poorly sorted becoming well-sorted basally - subangular
895 BOTTOM	OF HOLE	

ROTARY DRILL RECORD

Hole No.: 74 - 43A

Property: Sage Creek Coal

Location: North Hill
17,853,386N
586,804E

Elevation: 4498'

Contractor: Becker Drills Ltd.

Hole Size: 5 5/8" - 6 3/4"

Rig No.: 4518

Date Commenced Drilling: December 10, 1974

Date Finished Drilling: December 23, 1974

Date Hole Completed: December 23, 1974

Logged By: Robert Talbot & O. Cullingham

Date: December 23, 1974

Probed By: Roke Oil Enterprises Ltd.

Date: December 23, 1974

Total Depth Drillers: 1117'

Depth of Overburden: 5'

Total Depth Logger: 1115'

Water Level: Flowing

Bit Record

No.	Size	Make and Serial No.	R.P.M.	On	Off	Footage	Drilling Time
1	6 3/4	Hughs 065706204 WL-444 Button Bit		8'	721	713'	160 hrs.
2	6 3/4	Hughs Button Bit		721	836	115'	25 hrs.
3	6 3/4	W.M. #1 45963		836	958	122'	44 hrs.
4	5 5/8"	W.M. #1		958	1117	159'	13 hrs.

Surface Casing: 8'
Total Drilling Time: 298 hrs.
Total Down Time: 12 hrs.
Total Footage Chargeable: 83.5 (Cored)
Total Hourly Contact: 296 hrs.

Standby Time for Logging: 10 hrs.
Other Standby Time: ——
Total Chargeable Standby Time: 10 hrs.
Actual Moving Time Between Holes: 6 hrs.
Chargeable Moving Time " " :——

Remarks:-
Water flowing @ approx. 80 galls/min @ T. D.
Coal Horizon 5 badly caved

Quantity of Mud Used:
Quik Gel - 190 bags - 50# bags
Quik Seal - 2 bags - 40# bags
Baroid - 110 - 100# bags
Caustic Soils-1 bag - 50# bags

Probe Report:

113 - 0	Gamma/Neutron	Thru Double Walled Pipe
1086 - 0	Sidewall Densilog	Open Hole
1064 - 0	Caliper	Open Hole
975 - 21	E-Log	Open Hole

Coal Horizons

Coal Horizon	Drillers Picks			Log Picks		
Seam 2	519 - 528	9')	17'	516' - 524	8')	23'
	530 - 536	6')		528' - 539'	11')	
Seam 4 U	690 - 720'	30'		689' - 720'	31'	
Seam 4 L	764'- 772'	8'		763' - 773'	10'	
4 L	818 - 834	16'		809 - 820	11'	
Seam 5	1056 - 1110	54'		1042 - 1050	8')	46'
				1057 - 1088	31')	

INTERVAL	UNIT THICKNESS	HOLE 74-43A DESCRIPTION PAGE 1
	<5	OVERBURDEN - Glacial till
0 - 40	40'	QUARTZITE - Sandstone - SS - light grey - Fe. stn. - f. gr. - qtz. chert - p. sorted - tr. calcite
40 - 150	110'	CONGLOMERATE TO CONGLOMERATIC SANDSTONE - light brown to m. gy. - chert, quartzite, ss. pbl. frags. - SS matrix - f-m. gr., p. sort. Fe. stn. - sub. md. gr. - varies from 10% to 70% pbl. frags. - Basal Elairmore Fm.
150 - 265	115'	SHALE WITH CARBONACEOUS SHALE AND THIN COAL SEAMS - lt. to dk. gy. - minor amount micro-muscovite - tr. marcasite (usually associated with curb. sh. & shaly coal). - in part slty. to sdy. 177 - 185 SANDSTONE - lt. to m. gy., f. gr. ss., tr. marcasite 185 - 245 - Several coal to shaly coal seams to 3' thick.
265 - 330	65'	SANDSTONE - lt. grey - v. f. gr. to med. gr. p-mod. sort. - poor porosity - A to r. - qtz. < chert; approx. 30% chert gr. - tr. coal @ 300 - 320 (Prbly. from above. - tr. Fe. stn.
330 - 390	60'	SHALE, CARBONACEOUS SHALE AND THIN COAL AND SHALY COAL SEAMS SH m. to dk. gy., micro-mica., slty in part, sl. carb. h.v. carb. 355 - 375 - Coal Horizon No. 1 - 359 - 374- Cored - 359 - 360 - Coal tr. marcasite - 360 - 362 - Shale dk. gy., sl. carb. - 362 - 366 - Carb. to coaly shale with approximately 40% coal - tr. marcasite - 366 - 368 - Coal - some shale bnds. - 368 - 370 - Coaly Shale to shaly coal - 370 - 374 - Shale dk. gy., abnd. micro-mica., N 30% coal

INTERVAL	UNIT THICKNESS	DESCRIPTION
390 - 480	90	SANDSTONE - lt. gy. - f. gr., a-r., p. sort. - slt. & ppr. texture - chert & qtz. grain - sil. cmt. - p. poros.
480 - 522	42'	SHALE/SOME COALY SHALE - dk. gy., abnt. micro-mica, - tr. carb. to coal - slty. 490 - 510 - Sandstone light gy. - v. f. gr., mod. sort., - p. poros. - 30% chert frags. - arg. matrix
522 - 547	25'	COAL HORIZON no. 2 (516-539-Density log) 524 - 547 Cored 522 - 524 Shaly coal; 20 - 30% coal 524 - 528 Coal; trace marcasite 528 - 530 Shale; lt. to m. gy., minor amount micro-mica, ~ 5% coal 530 - 532 Coal - ~ 10% shale 532 - 534 Coal - ~ 20% shale frags. 534 - 536 Coal - ~ 10% sh. frags., tr. marcasite 536 - 538 Shaley Coal/ ~ 20-30% sh. 538 - 540 Shaley Coal, to 40% sh./tr. marcasite 540 - 542 Shale m. gy., abnt. micro muscovite, 10-20% coal frag., minor marcasite 542 - 544 Coaly Shale 40-50% coal frags. 544 - 546 Coal with 40% shaly coal 546 - 547 Shale tr. coal
547 - 570	23'	SHALE/SILTSTONE - m. gy., slty. becoming arg. sltst. downwards Grades into f. gr. sandstone - tr. carb. material at top of unit
570 - 645	75'	SANDSTONE - lt. grey - v.f. to f. gr., r to R., p. sort. - p. poros. - 10 - 20% chert frags. qtz-chert - silica cmt.
645 - 690	45'	SHALE - dk. gy. - abnt. micro mica - slty.

INTERVAL	UNIT THICKNESS	HOLE 74-43A DESCRIPTION PAGE 3
690 - 720	30'	COAL HORIZON 4U 692 - 721.5 Cored - 690 - 704 Coal, v. little arg. material tr. marcasite - 704 - 708 Shaley Coal up to 30% sh. frags., tr. marcasite - 708 - 712 Coal - 712 - 716 Shaley Coal/up to 30% sh. frag. - 716 - 720 Coal - tr. sh. frags. tr. marcasite
720 - 763	43'	SHALE - m. to m. dk. gy. - minor micro-mica - slty. - in part sdy. - tr. carb.& coaly material 720 - 721.5 Shale/coaly shale
763 - 772	9'	COAL HORIZON 4L 764 - 775 Cored 763 - 768 Coal tr. marcasite 768 - 772 Shaly coal - 20-30% sh. frags.
772 - 818	46'	SHALE - m. to dk. gy - minor micro-mica - minor slt.st. - sl. slty. in part - sl. carb./tr. coal
818 - 834	16'	COAL HORIZON 4L 829 - 834 Cored 818-820 - Coaly shale ∿ 40% coal frags. 820-822 - Shaly coal up to 40% shale frags. 822-829 - Coal 10 to 20% shale frag. 829-830 - Shaly coal with 30% sh. 830-833 - Coal tr. marcasite 833-834 - Shaly coal/ up to 30% sh. frags.
834 - 850	16'	SHALE AND SILTSTONE - dk. gy., curb. to coaly at top of unit - slty. to sdy. near base. Grades into underlying sandstone.
850 - 950	100	SANDSTONE - lt. gy. - v. f. to f. gr., a-A gr. - p. sort. - p. poros. - silica cmt. - qtz. ‹ chert gr.
950 - 1056	106	SHALE - lt. to m. gy. - slty: to sdy. in part - minor micro-mica - tr. coal throughout unit - prbly. cavings from above. 980 - 990 Sandstone/Shale ∿ 1:1 m. gy. v.f. gr., arg. matrix, sil. cmt.

INTERVAL	UNIT THICKNESS	DESCRIPTION
1056 - 1110	54'	COAL HORIZON NO. 5 NB Caving down hole resulted in coal returns after end of seam passed. G/N & Density Logs indicate Seam 5@ 1042 - 1088 1056 - 1060 Shaly coal - up to 30% sh. frags. 1060 - 1068 Coaly shale - up to 40% coal frags. 1068 - 1070 Shale - tr. marcasite N. 5% coal frags. 1070 - 1074 Coaly shale - up to 40% coal frags. 1074 - 1078 Shaly coal - up to 40% sh. frags. 1078 - 1110 Coal - Minor to 30% shale frags.
1110 - 1117	7'	Samples returned mostly shale and coal-cavings from above. Bit action as in shattered sandstone. TD

ROTARY DRILL RECORD

Hole No.: 74-44

Property: Sage Creek Coal

Location: North Hill
17,852,671 N
584,420 E

Elevation: 5191'

Contractor: Becker Drilling Ltd.

Hole Size: 5-1/8" - 5-7/8"

Rig No.: 45-20

Date Commenced Drilling: November 5, 1974

Date Finished Drilling: November 10, 1974

Date Hole Completed: November 10, 1974

Logged By: Jim Baker

Date: November 10, 1974

Probed By: Roke Oil Enterprises Ltd.

Date: November 10, 1974

Total Depth Drillers: 751'

Depth of Overburden: 5'

Total Depth Logger: 750'

Water Level: 220' or Elev 4971'

Bit Record

No.	Size	Make and Serial No.	R.P.M.	On	Off	Footage	Drilling Time

Surface Casing: 9'
Total Drilling Time: 113 hrs.
Total Down Time: 2 hrs.
Total Footage Chargeable: 751'
Total Hourly Contact: 7 hrs.

Standby Time for Logging: 5 hrs.
Other Standby Time: 10½ hrs.
Total Chargeable Standby Time: 15½ hrs.
Actual Moving Time Between Holes: 8 hrs.
Chargeable Moving Time " " : 6 hrs.
Quantity of Mud Used:

Remarks:-

Probe Report:

745 - 0 ..... Gamma Ray ..... Thru Double Walled Pipe
736 - 0 ..... Gamma/Neutron ..... Thru Double Walled Pipe

Coal Horizons

Coal Horizon	Drillers Picks		Log Picks		
Seam #2	222 - 230	8'	222 - 231	9')	20'
	236 - 244	8'	238 - 242	4')	
Seam #4 Upper	402 - 432	30'	400 - 431	31'	
Lower	456 - 478	22'	454 - 477	23'	
Seam #5	694 - 721	27'	692 - 701	9')	26'
			706 - 718	12')	

INTERVAL	UNIT THICKNESS	DESCRIPTION
0 - 10	10'	SANDSTONE - Light brown - Silica cmt - Fn grained - Sub rounded - Med porosity - Med sorting - Tr. chert & Fe st
10 - 70	60'	SHALE - Dk grey - Abd. micro-muscovite - Tr. SS
70 - 222	152'	SANDSTONE - Fine - med. grained - Lt. grey - Silica cmt. - Poorly sorted - Sub rounded - P. porosity - Tr. chert - Tr. Fe st
222 - 244	22'	COAL Seams #2 (& # 3) - Shaley throughout
244 - 402	158'	SHALE - Dk grey - Abd. micro-muscovite - Tr. coal
402 - 432	30'	COAL Seam #4 Upper
432 - 456	14'	SHALE - Dk. grey - Abd. coal
456 - 478	22'	COAL Seam #4 Lower
478 - 694	216'	SHALE - M - dk grey - Abd. micro-muscovite - Silty throughout - Tr. calcite - Tr, marcasite & coal
694 - 721	27'	COAL Seam #5
721 - 750	29'	SANDSTONE (BASAL SS) - Lt. grey - Silica cement - Fn. grained - Well sorted - M. porosity - Sub rounded - Clean

RIO TINTO CANADIAN EXPLORATION LIMITED

ROTARY DRILL RECORD

Hole No.: 74-45

Property: Sage Creek Coal

Location: North Hill
17,852,580 N
585,151 E

Elevation: 5053'

Contractor: Becker Drilling Ltd.

Hole Size: 5-1/8" - 5-5/8"

Rig No.: 45-20

Date Commenced Drilling: October 28, 1974

Date Finished Drilling: November 5, 1974

Date Hole Completed: November 5, 1974

Logged By: Jim Baker

Date: November 5, 1974

Probed By: Roke Oil Enterprises Ltd.

Date: November 5, 1974

Total Depth Drillers: 1006'

Depth of Overburden:

Total Depth Logger: 1002'

Water Level: 64'

Bit Record

No.	Size	Make and Serial No.	R.P.M.	On	Off	Footage	Drilling Time

Surface Casing: 6½'
Total Drilling Time: 211 hrs.
Total Down Time: 5 hrs.
Total Footage Chargeable: 1006'
Total Hourly Contact: -

Standby Time for Logging: 8 hrs.
Other Standby Time: -
Total Chargeable Standby Time: 8 hrs.
Actual Moving Time Between Holes: 2½ hrs
Chargeable Moving Time " " : ½ hr.
Quantity of Mud Used:

Remarks:-

Probe Report:

1002 - 0 ..... Gamma/Neutron .....Thru Double Walled Pipe
1000 - 0 ..... Sidewall Densilog .....Open Hole
990 - 0 ..... Caliper .....Open Hole
1001 -130 ..... E-Log .....Open Hole

Coal Horizons

Coal Horizon		Drillers Picks		Log Picks		
Seam #2		470 - 478	8'	468 - 478 486 - 488	10') 2')	20'
Seam #4	Upper	656 - 672	16'	648 - 666	18'	
	Lower	720 - 736	16'	715 - 734	19'	
Seam #5		925 - 974	49'	924 - 945 951 - 972	21') 21')	48'

INTERVAL	UNIT THICKNESS	DESCRIPTION
0 - 40	40'	CONGLOMERATE - White to dark grey - Tr. Fe. st. present - Chert & qtz. frags (crs)
40 - 150	110'	SANDSTONE - Med-crs. grained - Lt. - med. grey - Qtz. & Chert - Silica cmt. - Sub ang. - angular - Poorly sorted - Tr. marcasite & coal
150 - 220	70'	SHALE - M. grey - Abd. micro-muscovite - Somewhat argil. - Tr. marcasite
220 - 270	50'	SANDSTONE - Fine grained - Lt. brown - Limonite stain - Chert & quartz - Sub rounded - M. sorting - Silica cmt.
270 - 350	80'	SHALE - Dark grey - Abd. micro-muscovite - Coal present 305 - 318
350 - 420	70'	SANDSTONE - Fn-med. grained - Lt. - med. grey - Chert & qutz. matrix - Silica cmt. - Tr. calcite - Abd. shale - Sub angular
420 - 470	50'	SHALE - Abd. micro-muscovite - Dark grey
470 - 478	8'	COAL Seam 2
478 - 656	178'	SHALE - Dark grey - Abd. micro-muscovite - Quite silty throughout

INTERVAL	UNIT THICKNESS	DESCRIPTION
656 - 672	16'	COAL Seam # 4
672 - 720	48'	SHALE - M,grey - Tr,marcasite - Abd..micro-muscovite
720 - 736	16'	COAL Seam # 4 - Abd.shale present
736 - 810	74'	SHALE - M.grey - Tr.marcasite - Grading to silty
810 - 925	110'	SILTSTONE - M.grey - Qtz.& Chert - Silica cmt. - SS,stringer 850 - 870' - Grades to shale last 10'
925 - 974	49'	COAL Seam # 5 - 950 - 962 Shale stringer
974 - 1005	31'	SANDSTONE (BASAL SS) - Quartz rich - Lt.grey - white - Silica cement - Well sorted - Sub rounded - Fn-med.grained - Abd. shale & coal

ROTARY DRILL RECORD

Hole No.: 74 - 47

Property: Sage Creek Coal

Location: North Hill
17,852,613N
586,791E

Elevation: 4472'

Contractor: Becker Drilling Ltd.

Hole Size: 4 7/8" - 5 5/8"

Rig No.: 45 - 18

Date Commenced Drilling: Nov. 24, 1974

Date Finished Drilling: Nov. 28, 1974

Date Hole Completed: Nov. 28, 1974

Logged By: Jim Baker & R. Blakeney

Date: Nov. 28, 1974

Probed By: Roke Oil Enterprises Ltd.

Date: Nov. 28, 1974

Total Depth Drillers: 1016'

Depth of Overburden: 25'

Total Depth Logger: 1011'

Water Level: Flowing

Bit Record

No.	Size	Make and Serial No.	R.P.M.	On	Off	Footage	Drilling Time

Surface Casing: 11'
Total Drilling Time: 114 hrs.
Total Down Time: ——
Total Footage Chargeable: 1016'
Total Hourly Contact: 4½ hrs.

Standby Time for Logging: 5½ hrs.
Other Standby Time: ——
Total Chargeable Standby Time: 5½ hrs.
Actual Moving Time Between Holes: 9½ hr
Chargeable Moving Time " " : 7½ hr
Quantity of Mud Used:

Remarks:-

Hole made approx. 100 gals/min of water @ 850 ft.
Extreme sloughing due to washing by water

Probe Report:

1008 - 0	Gamma/Neutron	Thru Double Walled Pipe
100 - 0	Caliper	Open Hole

Coal Horizons

Coal Horizon	Drillers Picks		Log Picks	
Seam #2	550 - 558	8'	539 - 545	6'
Seam #4 upper	714 - 736	22'	702 - 724	22'
lower	771 - 779	6'	750 - 765	15'
Seam #5	966 - 998	32	951 - 963 973 - 988	12') 15') 37'

INTERVAL	UNIT THICKNESS	Hole 74-47 DESCRIPTION	PAGE 1
0 - 25	25'	OVERBURDEN - glacial till - ss., sltst. & chert frags., rnd. frags, gravelly	
25 - 85	60'	SANDSTONE - light brown grey - fine grained - argil. matrix - sub angular - p. sorted	
85 - 140'	55'	SHALE - lt. med. grey - variably silty - finely micacous - limy	
140 290	150'	SANDSTONE - white - lt. grey - med. grained - chert & qtz. - silica cement - p. sorted - sub angular - angular - chert frags present thruout	
290 - 360	70'	SHALE - med. grey - micro muscovite predom.	
360 - 550	180'	SANDSTONE - fn. grained - med. gray - qtz. & chert - silica cmt. - p. sorted - sub angular - 420 - 460 shaley coal stringer - shaley towards bottom	
550 - 558	8'	COAL Seam #2	
558 - 650	92	SHALE - med. gray - abd. micro muscovite	
650 - 714	64'	SANDSTONE - fine med. grained - med. gray - chert & qtz. - silica cmt. - p. sorted - sub angular	
714 - 736	22'	COAL - Seam #4 upper	

INTERVAL	UNIT THICKNESS	DESCRIPTION
736 - 771	35	SHALE - med. gray - micro muscovite
771 - 779	8'	COAL - Seam #4 lower
779 - 966	187'	SHALE - med. grey - micro muscovite - 890-910 sandstone stringer
966 - 998	32'	COAL - Seam #5 - argil.
998 - 1015	17'	SANDSTONE - Basal - white - lt. grey - med. grained - qtz. rich - silica cmt. - w. sorted - w. rounded

ROTARY DRILL RECORD

Hole No.: 74 - 48

Property: Sage Creek Coal

Location: North Hill
17,851,924N
584,401E

Elevation: 4827'

Contractor: Becker Drilling Ltd.

Hole Size: 4 7/8" - 5 1/8"

Rig No.: 45 - 15

Date Commenced Drilling: Oct. 17, 1974

Date Finished Drilling: Oct. 18,.1974

Date Hole Completed: Oct. 19, 1974

Logged By: Robert Talbot

Date: Oct. 19, 1974

Probed By: Roke Oil Enterprises Ltd.

Date: Oct. 19, 1974

Total Depth Drillers: 432'

Depth of Overburden: < 5'

Total Depth Logger: 431'

Water Level: 24' or elev. 4803'

Bit Record

No.	Size	Make and Serial No.	R.P.M.	On	Off	Footage	Drilling Time

Surface Casing: 11'
Total Drilling Time: 42 hrs.
Total Down Time: ——
Total Footage Chargeable: 432'
Total Hourly Contact: ——

Standby Time for Logging: 2 hrs.
Other Standby Time: ——
Total Chargeable Standby Time: 2 hrs.
Actual Moving Time Between Holes: 6 3/4
Chargeable Moving Time " " : 4 3/4
Quantity of Mud Used:

Remarks:- Strata above Seam 4u
appears misplaced - possibly small fault or slump structure
Seam 5 thinned - possible small fault

Probe Report:

429 - 0 Gamma/Neutron Thru Double Walled Pipe

Coal Horizons

Coal Horizon	Drillers Picks		Log Picks	
Seam 4 Upper	116 - 138	22'	111 - 123 127 - 140	12') 13') 29'
Seam 4 Lower	150 - 174'	24'	153 - 176	23'
Seam 5	382 - 394	12'	381' - 394	13'

INTERVAL	UNIT THICKNESS	Hole 74-48 DESCRIPTION	PAGE 1
0 - 24	24	SILTSTONE - light grey - abd. micro muscovite - calcite coating on 10% of frag - tr. Fe. staining - 20'-24' carb. to coaly sh./coal strgs.	
24 - 108	84	SILTY SHALE - m. grey - abd. micro muscovite - tr. calcite	
111 - 142	31'	COAL Seam 4u - 116 - 124 - abd. shale - 136 - 141 - abd. shale	
142 - 146	4'	SHALE - m. to dk. grey - abd. micro muscovite - coal - 5% - tr. marcasite	
146 - 176	30'	Shaley Coal Seam 4L	
176 - 205	29'	SHALE - dk. grey - abd. micro muscovite - tr. marcasite	
205 - 208	3'	COAL - stringer - shaley --> 60-70%	
208 - 290	82'	SHALE - dk. grey - abd. micro muscovite - 5% coal - 250' - 290' Silty	
290 - 330	40'	SILTSTONE - light grey - abd. micro muscovite - tr. marcasite - tr. ss.	
330 - 360	30'	SANDSTONE - light grey - silica cement - p. to m. sorting - f. grained - poor porosity - micro-muscovite - tr. marcasite - sub rounded	
360 - 382	22'	SHALE - light grey - abd. micro muscovite - tr. marcasite - angular qtz. x'shale	
382 - 396	14'	COAL Seam 5 - shaley - variable from 30% - 80%	

INTERVAL	UNIT THICKNESS	Hole 84-48 DESCRIPTION	PAGE 2
396 - 430	34 '	SANDSTONE & SHALE SS - "basal" - lightgrey, silica cement, 90% qtz. - sub rounded - med. porosity - med. grned. SHALE - Fernie - m. to dk. grey - abd. micro muscovite - tr. marcasite	

ROTARY DRILL RECORD

Hole No.: 74-49

Property: Sage Creek Coal

Location: North Hill
17,851,751 N
585,297 E

Elevation: 4829'

Contractor: Becker Drilling Ltd.

Hole Size: 5-1/8" - 5-5/8"

Rig No.: 45-20

Date Commenced Drilling: November 16, 1974

Date Finished Drilling: November 23, 1974

Date Hole Completed: November 23, 1974

Logged By: Jim Baker

Date: November 23, 1974

Probed By: Roke Oil Enterprises Ltd.

Date: November 23, 1974

Total Depth Drillers: 926'

Depth of Overburden: 5'

Total Depth Logger: 920'

Water Level: 34' or Elev 4795'

Bit Record

No.	Size	Make and Serial No.	R.P.M.	On	Off	Footage	Drilling Time

Surface Casing: 9'
Total Drilling Time: 187 hrs.
Total Down Time: 5 hrs.
Total Footage Chargeable: 926'
Total Hourly Contact: 1 hr.

Standby Time for Logging: 8½ hrs.
Other Standby Time: -
Total Chargeable Standby Time: 8½ hrs.
Actual Moving Time Between Holes: 7 hrs
Chargeable Moving Time " " : 5 hrs
Quantity of Mud Used:

Remarks:- A 30' stratigraphic thinning between Seams 41 & 5

Probe Report:

918 - 0	Gamma/Neutron	Thru Double Walled Pipe
917 - 0	Sidewall Densilog	Open Hole
917 - 0	Caliper	Open Hole
920 - 67	E - Log	Open Hole

Coal Horizons

Coal Horizon	Drillers Picks		Log Picks	
Seam #2	394 - 400	6'	386 - 395	9'
Seam #4 Upper	630 - 663	33'	626 - 657	31'
Lower	680 - 701	21'	676 - 696	20'
Seam #5	855 - 900	45'	856 - 873	17') 37'
			881 - 893	12')

INTERVAL	UNIT THICKNESS	DESCRIPTION
0 - 100	100'	CONGLOMERATE -Chert frags. -White - med.grey -V.crs. grained -Abd. SS. throughout
100 - 370	270'	SANDSTONE - Fn. - med.grained - Light grey - Silica cmt. - P. sorted - Sub rounded - Salt & pepper appearance
370 - 394	24'	SHALE - Lt.-med.grey - Abd. micro-muscovite - Slightly argil. - Tr. coal & marcasite
394 - 400	6'	COAL - Shaley throughout - Tr. marcasite
400 - 530	130'	SANDSTONE - Light grey - Silica cement - V. fn.grained - Med.sorting - Poor porosity - Sub rounded - Somewhat silty - 400 - 440 Shaley
530 - 630	100'	SILTSTONE - Light grey - Abd. micro-muscovite - Minor chert - Matrix Chert & qtz. - Silica cement
630 - 701	70'	COAL Seam #4 - Upper 630 - 663' - Lower 680 - 701'
701 - 770	69'	SILTSTONE - Lt. grey - Abd.micro-muscovite - Tr. coal - Chert & qtz. - Silica cement
770 - 855	85'	SANDSTONE - V. fn.grained - Lt. - med.grey - Qtz & chert - Silica cement - Sub ang - sub rounded - P. sorted - Abd. lcls. - tr. coal

INTERVAL	UNIT THICKNESS	DESCRIPTION
855 - 900	45'	COAL - Shaley & argil throughout - Seam #5
900 - 920	20'	SANDSTONE "BASAL" - Fn. - med.grained - White - lt grey - Qtz rich - Sub rounded - Med.sorting - Silica cement - Abd.coal present (sloughing from above)

ROTARY DRILL RECORD

Hole No.: 74 - 50

Property: Sage Creek Coal

Location: North Hill
17,851, 893N
585, 980E

Elevation: 4643'

Contractor: Becker Drilling Ltd.

Hole Size: 5 1/8" - 5 5/8"

Rig No.: 4518

Date Commenced Drilling: Nov. 15, 1974

Date Finished Drilling: Nov. 23, 1974

Date Hole Completed: Nov. 24, 1974

Logged By: Richard S. Blakeney

Date: Nov. 23, 1974

Probed By: Roke Oil Enterprises

Date: Nov. 24, 1974

Total Depth Drillers: 1081

Depth of Overburden: 30

Total Depth Logger: 1075

Water Level: Flowing

Bit Record

No.	Size	Make and Serial No.	R.P.M.	On	Off	Footage	Drilling Time

Surface Casing: 6'
Total Drilling Time: 200 hrs.
Total Down Time: 28 hrs.
Total Footage Chargeable: 1081'
Total Hourly Contact: ———

Standby Time for Logging: 9½ hrs.
Other Standby Time: ———
Total Chargeable Standby Time: 9½ hrs.
Actual Moving Time Between Holes: 6½ hr.
Chargeable Moving Time " " : 4½ hr
Quantity of Mud Used:

Remarks:-
Thickening of Horizon 5.
Flowing @ ~ 80 gal./min @ 527'.
Probable Fault @ 800' displacing 120'-150' of strata

Probe Report:

1073 - 0	Gamma/Neutron	Thru Double Walled Pipe
1068 - 0	Sidewall Densilog	Open Hole
1060 - 0	Caliper	Open Hole
1060 - 22	E-Log	Open Hole

Coal Horizons

Coal Horizon	Drillers Picks	Interval		Log Picks	Interval	
Seam 2	566 - 574	8		564 - 571	7'	
Seam 4U	790 - 802	12		784 - 796	12'	
Seam 5	850 - 882	32)	12	845 - 874	29')	55'
	892 - 904	12)		887 - 900	13')	
	922 - 952	30		918 - 924	6')	
				930 - 944	14')	26'

INTERVAL	UNIT THICKNESS	Hole 74-50 DESCRIPTION
0 - 30	30	OVERBURDEN
30 - 60	30	SANDSTONE - light brown - angular to sub rounded - fine grained - well sorted - 5% chert - siliceous cement - minor iron stain
60 - 95	35	SHALE - medium grey - micro micaceous - some interbedded siltstone
95 - 110	15	SANDSTONE - light grey - siliceous cement - well sorted - sub rounded - very fine grained
110 - 140	30	SHALE AND SILTSTONE INTERBEDDED SHALE - light grey - micro micaceous SILTSTONE - light grey - micro micaceous - slightly argillaceous - minor iron stain
140 - 320	180	CONGLOMERATE - chert pebble - sandstone matrix - some interbedded sandstone, siltstone and shale - minor amounts of coal
320 - 370	50	SHALE - medium to dark grey - variably silty - traces of coal - traces of marcasite - micro micaceous
370 - 550	180	CONGLOMERATE - chert pebble - sandstone matrix - traces of pyrite - interbedded with minor sandstone siltstone and shale - some coal basally
550 - 563	13	SHALE - medium to dark grey - micro micaceous - traces of coal - some interbedded siltstone

INTERVAL	UNIT THICKNESS	DESCRIPTION
563 - 571	8	COAL - Seam 2 - abundant interbedded shale - in part shaly coal - traces of pyrite
571 - 600	29	SHALE - dark grey - micro micaceous - trace of pyrite - minor thin coal stringers
600 - 635	35	SANDSTONE - medium grey - siliceous cement - angular - fine grained - poorly sorted - some interbedded shale
635 - 680	45	SHALE - in part silty - in part argillaceous - in part micro micaceous - dark grey
680 - 730	50	SANDSTONE - light grey - very fine to fine grained - poorly sorted - angular to sub rounded - siliceous cement - some interbedded shale
730 - 785	55	SHALE AND SILTSTONE INTERBEDDED SHALE - medium grey - micro micaceous - silty - minor coal stringers SILTSTONE - medium grey - micro micaceous - minor iron staining
785 - 798	13	COAL - Seam 4u - abundant interbedded shale - minor sandstone basally
798 - 830	32	SANDSTONE - light grey - siliceous cement - very fine grained - moderate sorting - sub rounded - very silty - traces of coal

INTERVAL	UNIT THICKNESS	DESCRIPTION
830-845	15	SHALE - medium grey - micro micaceous - trace of pyrite - some coal basally - silty
845-900	55	COAL - Seam 5 - shaly to blocky - abundant interbedded shale
900-918	18	SHALE - medium to dark gy. - coaly - slty. abndt. coal strgs.
918-944	26	COAL - Seam 5 - shaly - blocky -abundant interbedded shale
944-1081	137	SANDSTONE - light to medium grey - fine to medium grained - sub angular - mainly well sorted - occasional kaolinized feldspar - siliceous cement - some argillaceous zones -interbedded micaceous shales basally
1081		BOTTOM OF HOLE

ROTARY DRILL RECORD

Hole No.: 74-51

Property: Sage Creek Coal

Location: North Hill
17,851,056N
584,398E

Elevation: 4466'

Contractor: Becker Drilling Ltd.

Hole Size: 5 1/8"

Rig No.: 4515

Date Commenced Drilling: Oct. 15,1974

Date Finished Drilling: Oct. 17, 1974

Date Hole Completed: Oct. 17,1974

Logged By: Jim Baker

Date: Oct. 17, 1974

Probed By: Roke Oil Enterprises Ltd.

Date: Oct. 17, 1974

Total Depth Drillers: 301

Depth of Overburden: 50'

Total Depth Logger: 291

Water Level: 28' or Elev. 4438'

Bit Record

No.	Size	Make and Serial No.	R.P.M.	On	Off	Footage	Drilling Time

Surface Casing: 11'
Total Drilling Time: 49 hours
Total Down Time: _____
Total Footage Chargeable: 301'
Total Hourly Contact: 4½ hrs.

Standby Time for Logging: 8 3/4 hrs
Other Standby Time: _____
Total Chargeable Standby Time: 8 3/4hrs.
Actual Moving Time Between Holes: 8hrs
Chargeable Moving Time " " : 6 hrs.
Quantity of Mud Used:

Remarks:- 50' of overburden
Collared approx. 20' above base.
of Seam 5. Seam 5 eroded.

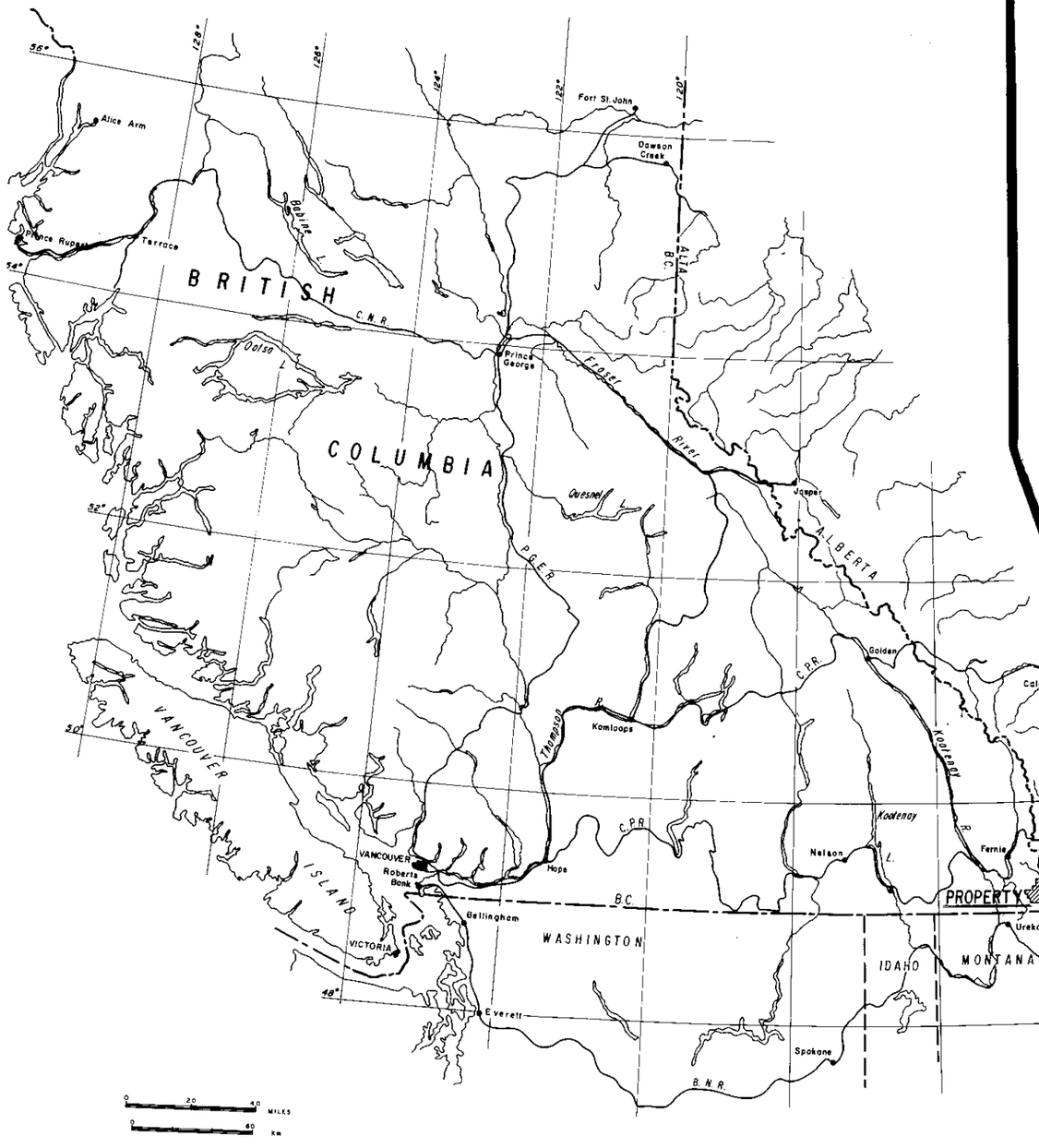
Probe Report:

289 - 0 .....Gamma/Neutron.....Thru Double Walled Pipe

Coal Horizons

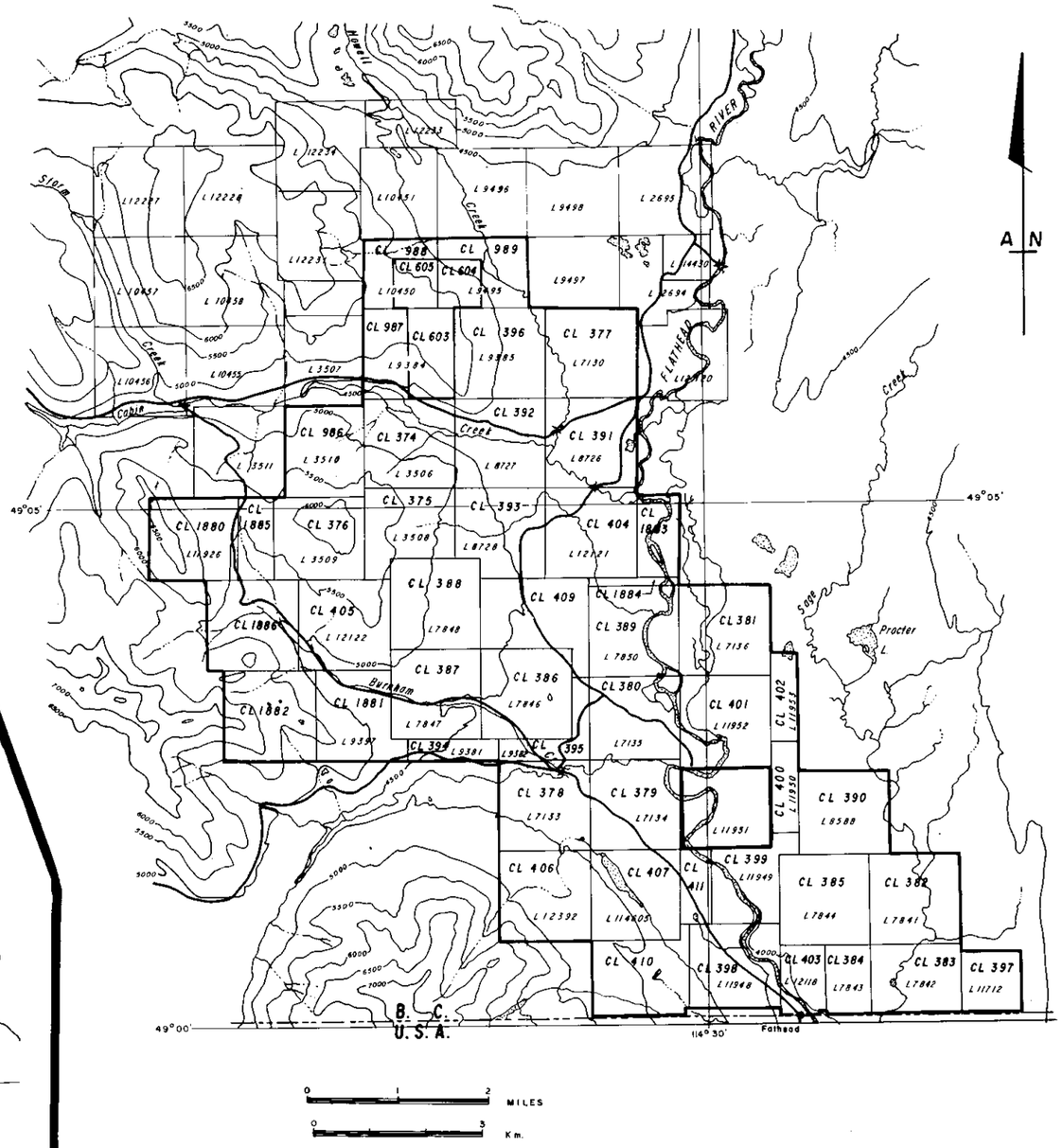
Coal Horizon	Drillers Picks		Log Picks	

INTERVAL	UNIT THICKNESS	DESCRIPTION Hole 74-51
0-50'	50'	OVERBURDEN - Glacial drift - Gravel - Broken Rock
50'-170'	120'	SANDSTONE - dk. gy. - m. gr. - mainly chert - m. sorting - sub angular - angular - silica cmt.
150' - 300'	150'	SHALE - dk. gy. - abd. micro muscovite - 150'-200' abd. slt. st. & SS present - SS stringer @ 290'



PROPERTY LOCATION MAP

SHOWING RAILWAYS TO VANCOUVER



LEGEND

——— Outline of property

L.11712 Lot number

CL.397 Coal Licence

NOTE: 603, 604 & 605 purchased from C.N.I. Nov. 1973

RIO TINTO CANADIAN EXPLORATION LTD.

SAGE CREEK COAL LIMITED - B.C.

PROPERTY PLAN

FEB. 1975 | O.C. / E.S. | DWG. L 2692

NTS 82-G-2

COAL ACT

(Section 19 & B.C. Reg. #436/75)

Exploration & Development Work Report Cover Sheet

Property name: Sage Creek Coal Coal Map No. 34

Location: Flathead Valley Land District Kootenay

Coal Licence No.(s) 374, 375, 392, 393, 396, 603, 604 and 989

Licensee: Sage Creek Coal Ltd.
120 Adelaide St. West, Toronto, Ont.

Operator: Rio Tinto Canadian Exploration Limited

Title of Report: Report on Exploration and Geology Volume 1 & 2
by H. W. Marsh and O. Cullingham Dated May 1975

Period covered by Report: June to December 1974

(Statement of costs: Sept.-Dec. 1974, Jan.-June 1975 $1,042,874.00)

Category of work covered in report (Totals of 5 attached application forms)

Geological Mapping	$42,394.00
Surveys: Geophysical	NIL
Geochemical	NIL
Other Drill hole collars	40,160.00
Road Construction	98,731.00
Surface work	47,083.00
Underground work	NIL
Drilling	429,922.00
Logging) Sampling) Testing)	162,104.00
Reclamation	27,695.00
Other work	194,787.00
Total value of work reported	$ 1,042,876.00

Comments:

Work credited to claims on N/G # 1 issued.

Value of work approved $ 1,042,876.00

Signature: A.R. James
Senior ~~Coal~~ Inspector of Mines Date Jan 28 1976

Accepted: [signature]
Chief Coal Commissioner
Mineral Resources Branch Date Jan 29 1976

#1

(To be prepared in duplicate: Original to be filed with report
Duplicate to be filed on Plan of Operations file)

Rio Algom
Rio Tinto

AUG 19 [illegible] AM

DEPT. OF MINES
AND PETROLEUM RESOURCES

August 16, 1974

Mr. A. R. Corner
Administrator for Coal
Dept. of Mines & Petroleum Resources
Government of British Columbia
VICTORIA, B. C.

Dear Mr. Corner:

Re: SAGE CREEK COAL LTD.

In reference to my letter of July 23 to the attention of Mr. R. Rutherford, we enclose the following:

Plans of adits showing the location of bulk samples for Adit No. 2, 73-2S, 73-5aS, No. 4.

We have asked Mr. W. J. Hennessey, our consultant on this project, to forward a copy of his progress report and plan for Adit 74-4S directly to you prior to August 25.

Trusting this will fulfill all requirements.

We remain,

Yours very truly,

RIO TINTO CANADIAN EXPLORATION LIMITED

D. J. Gervais

DJG/ll

Encl.

00365 (1)

Rio Tinto Canadian Exploration Limited
120 ADELAIDE STREET WEST, TORONTO CANADA M5H 1W5 416/367-4000 TELEX 02-2204 CABLE/RIOCANEX

82-G-2a

W. J. HENNESSEY CONSULTING LTD.
4124-26TH. STREET N.W. CALGARY 48, ALBERTA (403) 289-8321

August 15, 1974

Mr. A. R. Corner
Administrator for Coal
Department of Mines and Petroleum Resources
Government of British Columbia
Victoria, B. C.

Re: Application for Credit, Sage Creek Coal, Ltd.

Dear Mr. Corner:

At the request of Mr. D. Gervais of Rio Algom Mines Ltd., we are herewith submitting to you a copy of the plan, sections, and geological report for Adit 74-4F-S, which was driven on the Sage Creek property in July and August of this year.

Please refer to letter addressed to Mr. R. Rutherford, dated July 23, 1974.

Sincerely,

W. J. Hennessey, P. Geol.

Enclosures - Text, 3 Illustrations

C.C. Mr. D. Gervais.

AC
MR JAMES

REPORT ON

VISIT TO SAGE CREEK PROPERTY

AUGUST 1 & 2, 1974.

(Text and 4 illustrations)

Prepared for

Rio Algom Mines Ltd.,

by

W. J. HENNESSEY CONSULTING LTD.,

August 7, 1974.

REPORT ON VISIT

TO SAGE CREEK PROPERTY

AUGUST 1 & 2, 1974.

On August 1 & 2, 1974, the writer examined and measured adits 74-4F-S and 74-4U-S, on the north face of South Hill. At that time, work had been completed in 74-4F-S, and the miners were driving 74-4U-S, which was into the coal a distance of about 95 feet.

Both these adits are on the same stretch of road, and the writer directed the bulldozer operator to clean off the cutbank between the portals. It was thereby possible to compare the stratigraphy adjacent to the adits, and to expose a fault system which crosses the road just west of the portal of 74-4F-S. This fault system was then connected up with the faulting discovered in the adit. (see enclosed plan and diagram) At the road, four separate, but closely related faults are exposed; two of them dip westward, one is nearly vertical, and one is curved, so that the upper part dips west at 75 degrees, and the lower part dips east at 60 degrees. All contain clay gouge, which varies between one and three inches in thickness. Although a considerable amount of movement has taken place on these faults, one fault tends to cancel another, so that the net displacement across the zone is hardly more than about 10 feet, downthrown to the west.

On the plan, all these faults are indicated to merge into one, to the southward. There is no evidence to support such a supposition, because no crosscuts penetrated more than one or two feet beyond the first fault encountered. It may very well happen that this swarm of faults continues to the southward, into the hill.

The average trend of the faulting, as determined by joining up the road exposure with those in the adit and crosscuts, is almost due north. The main shale parting was intersected in the adit at a distance of about 355 feet in, and was followed to the face at 385 feet. At that point, the fault had almost reached the shale parting, so that the lower bench of the seam was entirely cut off. From about 320 feet, inward to the face, the adit was in a state of collapse, and timbering prevented effective examination of the ribs. The unstable condition was probably due to the convergence of the shale band and the fault, making for a very heavy roof condition.

The stub cross-cuts at 250 feet and at 200 feet were also examined. In the 250 feet place, the fault was exposed, striking due north, and dipping east at 78 degrees. In the 200 foot place, the footwall of the seam was reached, but shearing of the coal and rock suggests that the fault is only a few feet beyong the end of the cut.

The main cross-cut was driven at 150 feet in from the portal. It encountered the footwall 7.4 feet to the west of the adit, and the hanging-wall at 94.6 feet to the east of the adit.

The total length of the cross-cut is 102 feet. The seam was measured and described in this cross-cut, (see enclosed drawing) and was found to total 51.25 feet, which includes the median shale, of 4.3 feet in thickness. In general, the coal in this cross-cut looks good, and appears typical of No.4 Seam.

ADIT 74-4U-S.

The adit presently being driven was examined, and at the face was following a band of hard bright coal, which is believed to be between 7 and 12 feet below the hanging wall of Seam 4 (upper). At a distance of about 47 feet in from the portal, the adit encountered a fault to hard grey shale, which was marked by about 0.5 feet of mashed coal and shale, and 0.3 feet of clay gouge. The fault strikes N5W, and dips SW 83. The adit was turned, and has followed the fault inward. If the fault holds its present trend, it will reach the hanging-wall, and cut the seam off entirely, at an estimated distance of 150 feet from the portal.

Outside, on the road-cut, the fault is exposed in section. (see diagram) There it strikes N-S, and dips nearly vertical, with a wavering surface. It underlies a gully which can be followed uphill, to the next higher switchback road, where it is adjoined on the west by Seam 4. In this case then, it is possible to demonstrate that the downthrow is to the east, in the amount of about 100 feet. This is in all likelihood the same fault which cut off the coal in the west side of Adit 73-5-S, directly to the north, and downhill.

There is no doubt in the writer's mind that this adit is in the upper bench of Seam 4. The road exposures are very good, and display the same stratigraphic sequence as is found above adit 74-4F-S, and in drill hole SCC 21. Furthermore, the coal exposed at the portal is 25.5 feet in thickness, very similar to the 27.7 feet penetrated in the upper bench in Adit 74-4F-S. In drill hole SCC 21, 27.9 feet, true thickness, was intersected in the upper bench of Seam 4. In addition to all that, a very good visual correlation can be made between the Gamma-ray log of SCC 21 and the coal exposed at the portal. The main shale parting must occur just below road level, at the point where the fault crosses the road, and the lower bench would be found beneath that. Mr. Pewsey intends to check this latter point by drilling downward from the road outside the portal.

SUMMARY.

It has been demonstrated conclusively that both adits in the present program have encountered faults, which can be projected to exposures on the surface. Both adits are in Seam 4; one adit succeeded in cross-cutting the entire seam; the other adit is confined to the upper bench of the seam. In the one instance, the fault encompasses a zone 30 feet in width, in the other, the fault is very sharp, the total zone being less than one foot in width. On the wide fault, the net desplacement is small; on the sharp fault, the dispalcement is in the order of 100 feet. One fault is downthrown to the east, the other is downthrown to the west.

In all instances the faults are tight. The actual surfaces of movement contain a tough, plastic clay gouge, which goes to mud when exposed to water. A mashed zone, which might in some sense be termed a breccia, is present adjacent to the fault surfaces, but it is firm and coherent, and in no instance has it been found to be particularly permeable to water. There is no evidence, once beyond the zone of surface weathering, that the faults contribute to increased oxidation of the coal.

Several fault contacts have been exposed underground, and a complete, undistrubed section of Seam 4 was measured and described.

W. J. HENNESSEY CONSULTING LTD.

per/W. J. Hennessey, P. Geol.

ILLUSTRATIONS TO ACCOMPANY REPORT:

1. Adit 74-4F-S, Geology ✓
2. Adit 74-4A-S, Geology ?
3. Sketch of No.4 Seam in Road Cut at adit 74-4F-S ✓
4. Measurement of Seam in Crosscut 74-4F-S ✓

FACE AT 385'
Aug 1, 1974
FAULT IN RIGHT RIB
Coal highly sheared
Shale parting in rib & back
TIMBERED, RIBS LOOSE AND FALLING, ROOF VERY HEAVY, PROPS BUCKLING
Coal
Shear
Coal (sheared)
Fault
0.2' clay
shaly siltstone
A
A'
Moderately slickensided
coal completely slickensided
Shale & silt in rib at floor.
FAULT IN RIB
Fault surface 0.2' clay
Coal
Clean coal
Massive shale siltstone, No bedding visible
Prominent Slickensides
NOTE:
strike & dip on Slickensides
strike & dip on bedding
Seam nearly flat, sks. on bedding surfaces.
Crushed coal, Of Plastic Clay, Broken Shale & Silty Shale
CONTACT
HANGING-WALL
Bedding nearly flat, sks. at random orientation
Coal is banded, not severely sheared except at face.
Shale bank
Footwall
CROSS-CUT
Attitude measured on bedding in Coal
SEAM 4. UPPER
MAIN SHALE PARTING
Bright coal, sks on both ribs. No bedding dip obtainable
SEAM 4. LOWER
Hanging-wall No 4 Seam
BANK
Nearly Continuous Coal Outcrop
140'
N
ROADWAY
FOOTWALL CONTACT
PORTAL 74-4 (FAULT) S
Unfaulted Coal outcrop 40'
(SEE SKETCH SHOWING EXPOSURE ALONG ROAD-CUT)
SC 74(1)A

365 (1) (M1)

THE ASSOCIATION OF PROFESSIONAL ENGINEERS OF ALBERTA
PERMIT NUMBER P 652
W. J. HENNESSEY CONSULTING LTD.

44FS

ADIT 74-4-(FAULT) S.

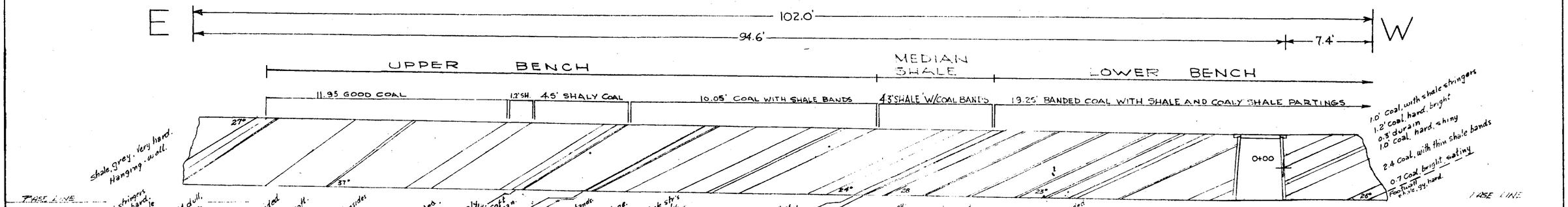
GEOLOGY

SCALE (Ft) 0 10 20 30 40
0 3 METERS 6 9 12

JULY 10, 1974 — B. PEWSEY, W. HENNESSEY
REVISED & EXTENDED AUG 1, 1974 — A. BEDFORD

SC 74(1)B

Prepared for
SAGE CREEK COAL LTD
by
W.J HENNESSEY CONSULTING LTD.
AUG 5, 1974
W.J. Hennessey, P. Geol.



SAGE CREEK, B.C. 44FS

MEASUREMENT OF SEAM IN CROSSCUT 74-44F-S
150' IN FROM PORTAL

SCALE: 1"= 5'

MEASURED BY A. BEDFORD AND W. HENNESSEY, AUG. 1, 1974

PREPARED FOR

SAGE CREEK COAL LTD

BY

W. J. HENNESSEY

W. J. Hennessey P. Geol.

365 (1) (M2)

365

SC 74(1)B

SC 74(1)A

Nº 1

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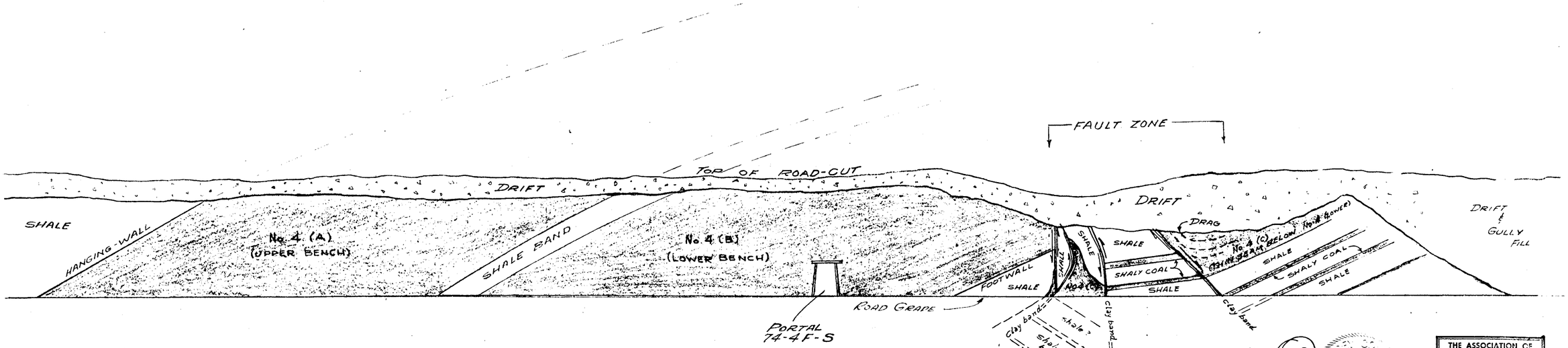

SKETCH OF No. 4 SEAM IN ROAD-CUT
AT ADIT 74-4F-S
SHOWING FAULTING AT FOOTWALL
W.J. HENNESSEY CONSULTING LTD. AUG 1, 1974
SCALE: 1in : 10ft. (APP)

SC 74(1)8 (M3)

365 (1)

THE ASSOCIATION OF PROFESSIONAL ENGINEERS OF ALBERTA
PERMIT NUMBER
P 652
W. J. HENNESSEY CONSULTING LTD.