| MAP NO.: | SUMMARY REPORT X | DOCUMENT NO: 093032 |
|---|---|---|
| 115 H /08 | PROSPECTUS | MINING DISTRICT: Whitehorse |
| | CONFIDENTIAL X | TYPE OF WORK: Trenching and Geological Evaluation |
| | OPEN FILE | |

**REPORT FILED UNDER:** W4 Joint Venture

**DATE PERFORMED:** August 22 to 25, 1991 **DATE FILED:** April 16, 1992

**LOCATION:** **LAT.:** 61°20'N **AREA:** Division Mountain Area

**LONG.:** 136°08'W **VALUE $:** N/A

**CLAIM NAME & NO.:** Coal Exploration Licences Y434 and Y435

**WORK DONE BY:** R.C. Carne

**WORK DONE FOR:** W4 Joint Venture

**DATE TO GOOD STANDING:**

| | |
|---|---|
| | |
| | |
| | |
| | |

**REMARKS:** # 115 - H - Division Mountain Area
The company carried out limited trenching and evaluated the deposit's potential to host coal bed methane. Trenching failed to reach bedrock. Coalbed methane potential ranges from 17.5 billion cubic metres to 75 billion cubic metres.

ARCHER, CATHRO
& ASSOCIATES (1981) LIMITED
CONSULTING GEOLOGICAL ENGINEERS

1016 - 510 West Hastings Street
Vancouver, B. C. V6B 1L8
(604) 688-2568



# SUMMARY REPORT

on the

DIVISION MOUNTAIN COAL PROJECT,

SOUTHERN YUKON

for

W4 JOINT VENTURE

on

COAL EXPLORATION LICENCES Y434 AND Y435

Latitude 61°20'N; Longitude 136°08'W

NTS 115H/8

R.C. Carne, M.Sc.

January, 1992



BOX 4127, 3125 THIRD AVENUE, WHITEHORSE, Y.T. Y1A 3S9
(403) 667-4415

## TABLE OF CONTENTS



## LIST OF TABLES



## APPENDICES



## LIST OF FIGURES

## SUMMARY AND RECOMMENDATIONS

The Division Mountain coal occurrence is held exclusively by W4 Joint Venture through Territorial Coal Exploration Licences Y434 and Y435. The Coal Licences total 27,705.8 hectares and are valid for a three year term which expires April 17, 1993 at which time title can be converted to coal claims or mining leases.

The coal deposit lies 20 km west of the Klondike Highway and the Whitehorse-Faro power line. Access is by a 27 km long four-wheel drive road which leaves the Klondike Highway at the small community of Braeburn.

The Division Mountain coal occurrence was first explored in 1970 to 1972 with bulldozer trenching and diamond drilling. W4 Joint Venture carried out surface mapping and trenching in 1990 and 1991. A coal exposure in a 1972 bulldozer trench was remapped and carefully sampled in 1990 by the Geological Survey of Canada (GSC) which carried out detailed analyses on the samples in 1991. Another coal exposure on Red Ridge, 5 km to the northwest, has never been explored.

The Division Mountain coal occurrence lies near the top of the Lower to Middle Jurassic Laberge Group along the northeast limb of a northwest-trending syncline. Coal-bearing rocks are interbedded sandstones and shales in roughly equal proportions. Over thirty coal seams are present in the 600 m thick coal measures. These occur in three groups or series that are each separated by about 80 m of barren stratigraphy.

Greatest mineable coal potential discovered to date lies within the Cairnes Seam which occurs near the base of the coal measures. Average thickness of this seam over the 840 m explored strike length is 7.8 m. Measured reserves of 2.6 million tonnes are present in the Cairnes Seam for an average downdip distance of 300 m from surface. A 1971 calculation which assumed continuity between the

Division Mountain and Red Ridge coal occurrences estimated inferred coal reserves in the Cairnes Seam to a 275 m depth at 32 million tonnes with additional possible reserves estimated at 21 million tonnes. If the quantity of coal that occurs in the 600 m section of coal measures explored by 1972 drilling (24.8 m aggregate thickness of coal seams thicker than 0.5 m) continues across the area of the Division Mountain syncline, a resource potential of 2.8 billion tonnes is present.

Results of proximate analyses carried out in 1972 and petrological and geochemical studies performed by the GSC in 1991 determined that the Cairnes Seam has excellent thermal characteristics with an ASTM rank classification of High Volatile Bituminous B and a calorific value of about 7500 kcal/kg (13,500 Btu/lb). Weighted average ash content for the seam (exclusive of major partings) is 21.8%. Much of the ash probably occurs as adventitious material which could be removed by washing. Sulphur content (0.3%) and trace element contents are very low.

The coal basin appears to have good potential for coalbed methane. Coalbed methane can be recovered from wells that intersect the coal measures without materially altering the calorific values of the coal. It is invariably low in H2S and SO2, nitrous oxides, CO2 and higher hydrocarbons (ethane, propane, etc). Coalbed methane has an energy value similar to, and substitutes readily for, natural gas. Depending on the method of calculation, coalbed methane potential of the Division Mountain area ranges from 17.5 billion cubic metres to 75 billion cubic metres. This compares to the seven billion cubic metre proven reserve of the Kotaneelee natural gas field in southeast Yukon.

Further exploration should consist of geological mapping and geophysics to outline targets for additional diamond drilling along strike of the known coal.

In addition to proximate and ultimate analyses, the coal should be tested for coalbed methane potential. This is a low cost procedure that can be performed on site. A proposed budget for further work follows.

PROPOSED 1992 EXPLORATION BUDGET
DIVISION MOUNTAIN COAL OCCURRENCE

| | |
|---|---|
| Diamond Drilling - 1200 m NQ @ $150/m | $180,000 |
| Salaries - geologist for 4 months; 3 labourers and cook for 2 months; 60 days senior supervision; expediting, accounting and secretarial | 100,000 |
| Field Room and Board - 1000 mandays @ $80/manday | 80,000 |
| Bulldozer - 200 hrs D-6 @ $110/hr, including fuel | 22,000 |
| Coal Analyses - 30 @ $600 | 18,000 |
| Geophysics - 9 line km VLF-EM @ $1000/km | 9,000 |
| Truck Rental | 6,000 |
| Travel and Freight | 5,000 |
| Drafting and Printing | 5,000 |
| Linecutting - 5.0 km cut @ $300/km = $1500<br>- 10 km cleaned up @ $150/km = 1500 | 3,000 |
| Management | 20,000 |
| | $448,000 |
| Plus 7% GST | 31,360 |
| TOTAL - | $479,360 |

Respectfully submitted,

ARCHER, CATHRO & ASSOCIATES (1981) LIMITED

R.C. Carne, M.Sc.

/mc

## INTRODUCTION

The Division Mountain coal occurrence was acquired by W4 Joint Venture on April 17, 1990 through application for Territorial Coal Exploration Licences Y434 and Y435.

The 1991 exploration described in this report was funded by W4 Joint Venture. It was carried out during the period August 22-25, 1991 and consisted of excavator trenching, geological mapping and inspection of old surface workings. Results of this work were compiled with data resulting from previous exploration and research during December, 1991 and January, 1992.

Appendix I includes the Author's Statement of Qualifications while a list of personnel who worked on the project is included as Appendix II.

## PROPERTY, LOCATION AND ACCESS

The Coal Exploration Licences total 27,705.8 hectares and are valid for a three year term which expires April 17, 1993. Coordinates of the four corners of the Coal Exploration Licences are given in Table I.

TABLE I
DESCRIPTION OF COAL EXPLORATION LICENCES

| | Northwest Corner | Northeast Corner | Southeast Corner | Southwest Corner | Area |
|---|---|---|---|---|---|
| CEL Y434 | 136°15'00"W<br>61°30'00"N | 136°00'00"W<br>61°30'00"N | 136°00'00"W<br>61°22'30"N | 136°15'00"W<br>61°22'30"N | 9,084.7 hectares*<br>22,448 acres |
| CEL Y435 | 136°15'00"W<br>61°22'30"N | 136°00'00"W<br>61°22'30"N | 136°00'00"W<br>61°15'00"N | 136°15'00"W<br>61°15'00"N | 18,621.1 hectares<br>46,012 acres |

*area of CEL Y434 is partially reduced by a land withdrawal pending settlement of Native Land Claims.

The Division Mountain coal occurrence is located on NTS mapsheet 115H/8 in the central part of the two adjoining licenses, 80 km northwest of Whitehorse and 275 km from tidewater at Skagway, Alaska (Figure 1). The Whitehorse-Faro power line lies some 20 km from the deposit in a straight line. The small community of Braeburn on the Klondike Highway is 27 km northeast of the Division Mountain coal deposit by four-wheel drive road. The road follows the old Whitehorse-Dawson Trail for the first 20 km in a southerly direction before branching off to the west along a 7 km long section built to the deposit in 1970. There are four creek crossings (Figure 1) that might require bridging. The first at Km 1.7 is a broad shallow ford of Klusha Creek at the outlet of Braeburn Lake. The second crossing of Klusha Creek at Km 12.0 is similar except that a 100 m section of the road upstream of the crossing has suffered washouts during high water. The crossing of Joe Creek at Km 14.5 is shallow and presents no obstacle to passage. The road between the Joe Creek crossing and the third crossing of Klusha Creek at

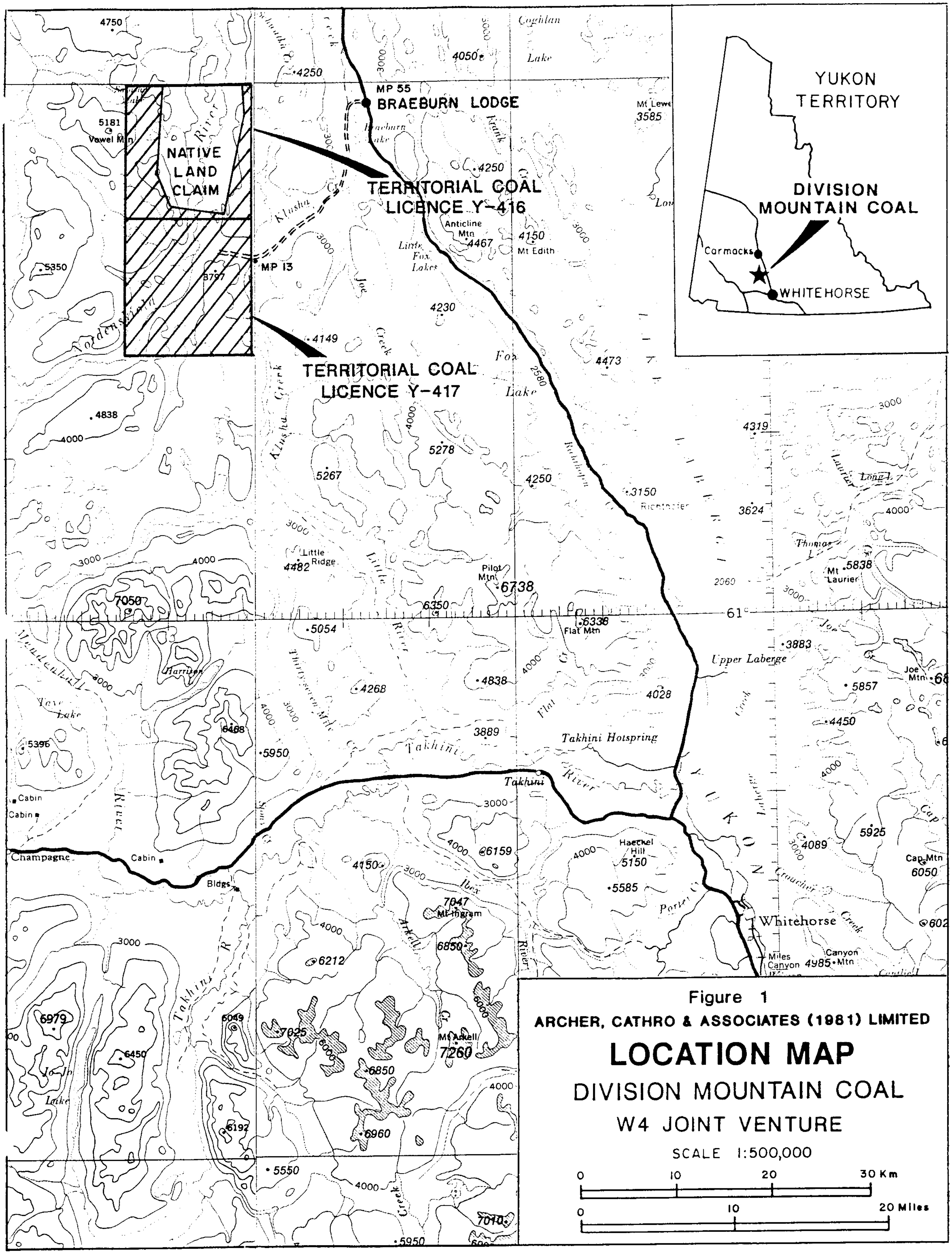



Figure 1

**ARCHER, CATHRO & ASSOCIATES (1981) LIMITED**

# LOCATION MAP

## DIVISION MOUNTAIN COAL

## W4 JOINT VENTURE

SCALE 1:500,000

0 10 20 30 Km

0 10 20 Miles

Km 23 traverses numerous swampy, wet areas. The third crossing of Klusha Creek is soft and almost impassable at high water. The worst stretch of the road is between Km 12 and 23 and three of the creek crossings could be eliminated by rerouting the road west of Klusha Creek. This route involves only five small creek crossings which could be accommodated with culverts.

## HISTORY AND PREVIOUS WORK

In 1907, D.D. Cairnes of the GSC mapped and sampled three coal seams which outcrop in Teslin Creek ravine, 2 km north of Division Mountain. Another coal outcrop was also located by Cairnes at the base of Red Ridge, 5 km to the northwest of the Teslin Creek occurrences.

During the period 1970-72, Arjay Kirker Resources Ltd. carried out road building, bulldozer trenching, sampling, test resistivity surveys and diamond drilling over the coal outcrops near Teslin Creek. In 1990, one bulldozer trench was remapped and carefully sampled by A.R. Cameron of the GSC. Detailed analyses of the trench samples were carried out in 1991 by the GSC.

## GEOMORPHOLOGY

The Division Mountain area lies within Yukon Plateau. Relief is moderate, consisting of rolling hills and broad, flat valleys (Figure 2). Elevations vary from about 750 to 1200 m in the eastern and southern part of the licences. In the northwest part of the area, across the Nordenskiold River area, relief is greater with local elevations exceeding 1500 m. The area appears to have escaped Pleistocene glaciation but glaciofluvial outwash and loess exceeding 30 m in thickness mantles the area below 900 m elevation. Above this, residual overburden cover is thin and bedrock exposures are more common. Permafrost is probably discontinuous to absent over most of the area.

# GEOLOGY

## REGIONAL GEOLOGY

Coal-bearing sandstone and shale of the Lower and Middle Jurassic Laberge Group are disconformably overlain by Upper Jurassic and/or Cretaceous Tantalus Formation pebble conglomerate and sandstone (Figure 2). Upper Cretaceous Carmacks Group hornblende greywacke and volcanic breccia unconformably overlie the folded sedimentary rocks as erosional remnants of a thin, relatively flat-lying veneer. Andesite porphyry dykes and sills related to the Carmacks Group volcanic rocks occasionally intrude the coal measures.

## GEOLOGY OF THE COAL MEASURES

Geology of the coal measures is summarized from reports describing results of 1970-72 exploration and from results of a detailed 1990-91 investigation of a bulldozer trench exposure of the Cairnes Seam on the north side of Teslin Creek by A.R. Cameron and A.P. Beaton of the GSC, Institute of Sedimentary and Petroleum Geology, Calgary (Appendix III).

The coal measures outcrop along Teslin Creek on the east limb of a regional-scale syncline (Figure 3). Beds strike about N50°W and dip about 60° to the southwest. The 1972 drilling was carried out in this area as a fence across a stratigraphic interval of 600 m with one step-out hole 600 m along strike to the northwest. Over thirty coal seams were intersected with the informally named Cairnes Seam having the most economic potential. The Cairnes Seam occurs about 450 m stratigraphically below the base of the Tantalus Formation. The Red Ridge coal outcrops are 5 km northwest of Teslin Creek and apparently occur about 245 m below the base of the Tantalus Formation.

Coal seams occur in three groups or series that are separated by about 80 m of barren stratigraphy. Greatest mineable coal potential discovered to date lies within the Cairnes Seam which occurs near the base of Series 1 (Figure 4).

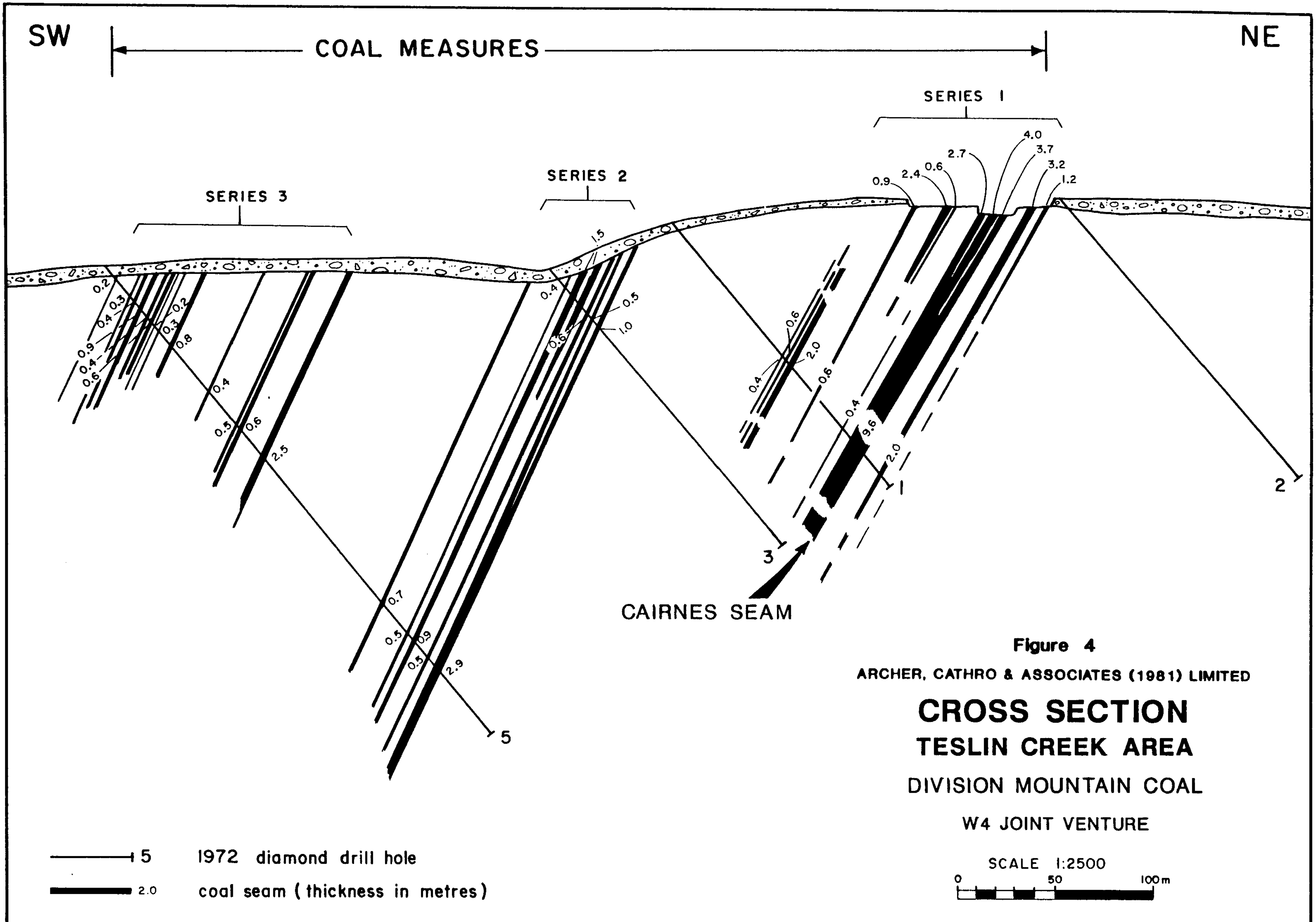



**Figure 4**

ARCHER, CATHRO & ASSOCIATES (1981) LIMITED

# CROSS SECTION
## TESLIN CREEK AREA

DIVISION MOUNTAIN COAL

W4 JOINT VENTURE

Coal-bearing rocks are interbedded sandstones and shales in roughly equal proportions. The 1 to 10 m thick sandstone intervals are moderately indurated, coarse grained to gritty in texture and contain numerous carbonaceous shale and coal partings. Silty shale intervals are massive and relatively competent, ranging up to 60 m thick. Coal seams are dull black in colour and occasionally contain narrow partings of carbonaceous shale.

The Cairnes Seam is exposed in a bulldozer trench on the north rim of Teslin Creek Canyon. The seam consists of three main benches, separated by two clay and sand partings, 92 and 54 cm thick. True thickness of the seam is about 12.5 m (Figure 5). Southeast of Teslin Creek, trenching has only partially exposed coal-bearing bedrock while, 580 m northwest of Teslin Creek, a trench exposure of the Cairnes Seam has a true thickness of 7.3 m. In Hole 1, 240 m northwest of Teslin Creek, the Cairnes Seam is 9.6 m thick at a depth of about 120 m from surface. The Cairnes Seam was intersected in Hole 6, 690 m northwest of Teslin Creek, where it is separated into two benches, the upper 0.6 m thick and the lower 4.7 m thick, which are separated by 3.5 m of interbedded shale and sandstone. These variations demonstrate a consistent, even increase in thickness of the Cairnes Seam to the southeast where no exploration has yet been carried out.

A coal seam that varies between 2.0 and 3.2 m thick occurs 7.5 m stratigraphically below the Cairnes Seam near the base of Series 1 (Figure 4). The thickest coal intersection from Series 2 was one of 2.9 m. The only coal intersected thicker than 1 m within Series 3 was a 2.5 m seam at the base of the interval.

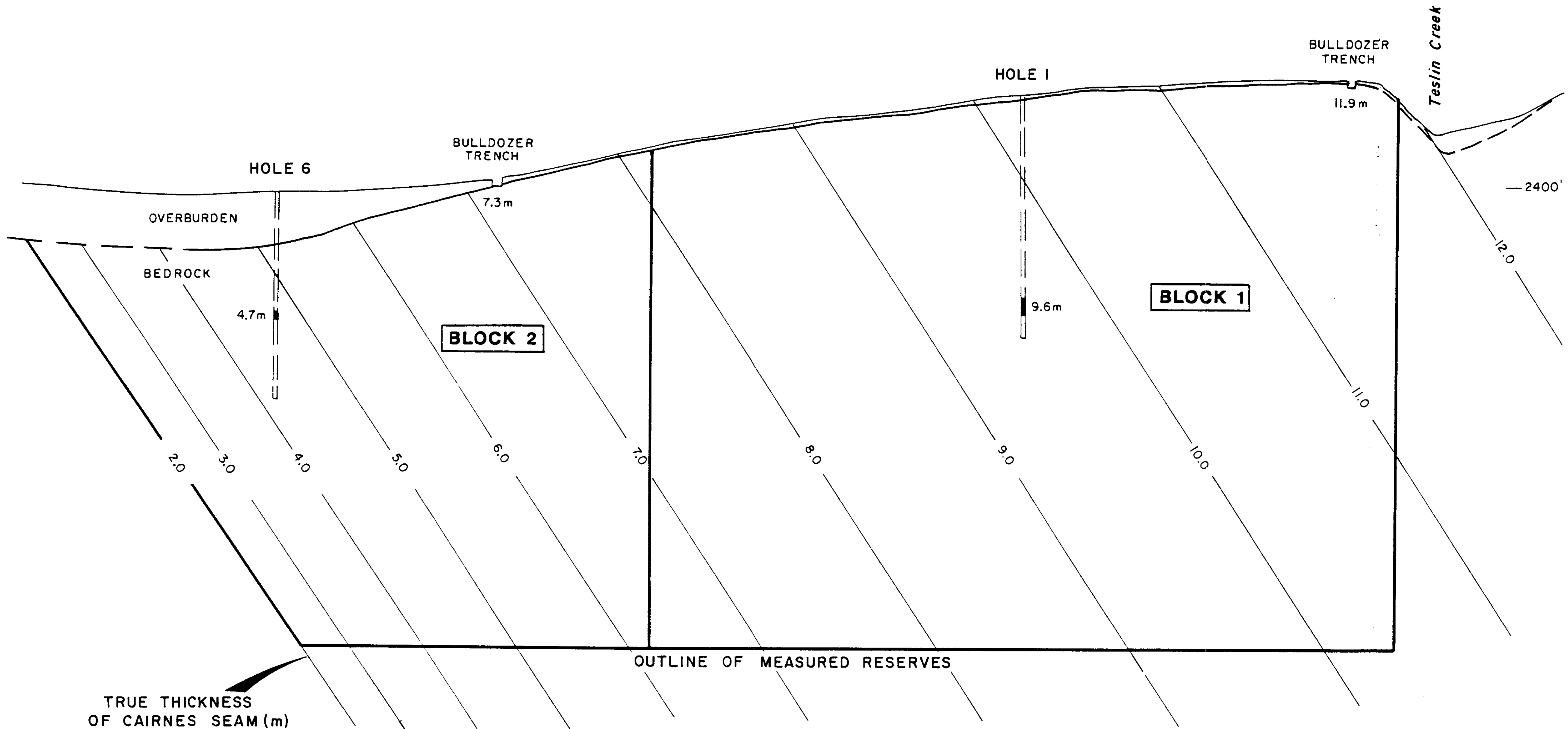



Figure 5

**ARCHER, CATHRO & ASSOCIATES (1981) LIMITED**

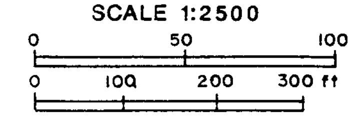
# LONGITUDINAL SECTION

## CAIRNES SEAM

DIVISION MOUNTAIN COAL

W4 JOINT VENTURE

SCALE 1:2500



## COAL RESERVES

Figure 5 shows the basis for coal reserve calculation for the Cairnes Seam. Explored strike length of coal greater than 2 m thick totals 840 m, 450 m between the two drill holes, with a projection of 160 m to the northwest of Hole 6 and 230 m to the southeast of Hole 1.

Method of reserve calculation is documented below.

| | | | |
|---|---|---|---|
| Block 1 - | | 144,000 m2 | (area) |
| | x | 9.0 m | (average thickness) |
| | = | 1,296,000 m3 | (volume) |
| | x | 1.5 g/cm3 | (specific gravity) |
| | = | 1,944,000 tonnes | |
| Block 2 - | | 77,000 m2 | (area) |
| | x | 5.5 m | (average thickness) |
| | = | 423,500 m3 | (volume) |
| | x | 1.5 g/cm3 | (specific gravity) |
| | = | 635,250 tonnes | |
| Total tonnage | = | 2,579,250 tonnes | |

The reserves total approximately 2.6 million tonnes which can be classified as measured because of the good continuity of the seam. The potential for increasing reserves is excellent along strike to the southeast where the thickest known accumulations are present.

A 1971 calculation by R.J. Kirker which assumed continuity between the Division Mountain and Red Ridge coal exposures estimated inferred coal reserves in the Cairnes Seam to 275 m depth at 32 million tonnes with additional possible reserves estimated at 21 million tonnes.

The Division Mountain coal prospect occurs on the northeast limb of a northwesterly-trending syncline. Total area of potential coal-bearing stratigraphy within the poorly exposed basin is about 75 square kilometres. If the quantity of coal that occurs in the 600 m section of stratigraphy explored by 1972 drilling (24.8 m aggregate thickness of coal seams thicker than 0.5 m) continues across the basin, a resource potential of 2.8 billion tonnes is present.

COAL QUALITY

Proximate analyses of coal collected from diamond drill core were carried out in 1972 by Birtley Engineering (Canada) Ltd. of Calgary. Petrological and geochemical studies were carried out in 1991 by the GSC (Institute of Sedimentary and Petroleum Geology in Calgary) from a channel sample collected from the bulldozer trench exposure of the Cairnes Seam at Teslin Creek (Appendix III). Results of both the 1972 and 1991 analyses are summarized with data from other thermal coal deposits on Table II.

Based on 1991 vitrinite reflectance determinations and the 1972 proximate analyses, the Cairnes Seam is assigned an ASTM rank classification of High Volatile Bituminous B with a calorific value of about 7500 kcal/kg (13,500 Btu/lb).

In the bulldozer trench exposure, the upper and middle benches of the seam contain 17.5% ash while the lower bench contains 26% ash (exclusive of major partings). Weighted average ash content for the whole seam (exclusive of major partings) is 21.8%. This compares with a 31.3% ash content of drill core from the Cairnes Seam which includes adventitious material in a number of partings up to 10 cm which could be easily removed by washing.

Sulphur content of the coal is low enough at 0.3% that expensive scrubbers would not likely be required if the coal is used for thermal power generation. Trace element content is also low with average selenium values of 0.6 ppm, antimony values of 0.5 ppm and arsenic values of 3.0 ppm. Results of detailed trace element analyses are given in Appendix III.

The coal has a high liptinite content (spores, cuticular plant matter, resins and waxes) and this, coupled with the high volatile rank, suggests that the potential for significant coalbed methane resource is high.

TABLE II
THERMAL COAL QUALITY VALUES

| | Ash (%) | Volatile Matter (%) | Fixed Carbon (%) | Total Sulphur (%) | Calorific Value (kcal/kg)* | Total Moisture (%) |
|---|---|---|---|---|---|---|
| Typical Limits | <30 | 15-35 | --- | <1.0 | >5700 | <12 |
| Division Mtn. (1990 trench sampling) | 21.8 | --- | --- | 0.3 | 7500 | --- |
| Division Mtn. (1972 drill holes) | 31.3** | 22 | 45 | 0.5 | 7130-7870 | 2.5 |
| Byron Creek, B.C. | 15.1 | 22.6 | 54.3 | 0.3 | 6370 | 8 |
| Green Hills, B.C. | 16 | 25-28 | 55 | 0.5 | 6900 | 10 |
| Line Creek, B.C. (unwashed) | 23 | 17-20 | --- | 0.5 | 6400 | 6 |
| Line Creek, B.C. (clean) | 17 | 21 | --- | 0.5 | 6400 | 8 |
| Fording, B.C. | 15 | 22 | 55 | 0.5 | 7000 | 8 |
| Telkwa, B.C. | 11 | 25 | --- | 1.0 | 6500 | 10 |
| Quinsam, B.C. | 13.5 | 36.5 | 48 | 1.0 | 6200 | 8 |
| Tuya Basin, B.C. | 19.1 | 30.7 | 37.8 | 0.5 | 6660 | 12.4 |
| Typical Alberta high volatile bituminous | 15-30 | 35-40 | --- | 0.3-0.4 | 4200-5600 | 6-9 |
| Warrior Basin, Alabama | 2.5-16 | 30-45 | 49-65 | 0.7-3.1 | 7000-8400 | 1-4 |

*1 kcal/kg = 1.8 Btu/lb
**includes partings up to 10 cm

## COALBED METHANE POTENTIAL

Coalbed methane is a gas created as a result of coal formation. From the earliest days of coal mining, coalbed methane has been a safety hazard. Programs of coal basin degassification by drilling wells in advance of mining have recently evolved to collect and distribute methane as a substitute for natural gas. In the past decade, exploration programs primarily directed at the coalbed methane potential of coalfields have been carried out in the United States and western Canada. Coalbed methane reserves in the United States are estimated to be in excess of four times the reserves of conventional natural gas.

Natural gas is 74% methane (CH4). Gas from coal beds is 98% methane and is invariably low in H2S and SO2, regardless of the sulphur content of the coal and coal measures. Nitrous oxides, CO2 and higher hydrocarbons (ethane, propane, etc.) occur in trace to minor amounts. Coalbed methane has a calorific value similar to, and substitutes readily for, natural gas.

First significant development of a coalbed methane field in the United States took place in 1977 at the Oak Grove coal mine in the Warrior Basin, Alabama. The initial field consisted of a 23 well grid designed to degas a coal seam at an average depth of 300 m in advance of underground mining. Methane from these wells was initially vented but, starting in late 1981, it was gathered and sold. In 1982, an additional 15 wells were added to the Oak Grove field which by 1989 had 163 producing wells and had yielded over 280 million cubic metres of gas.

The gas content of a coal bed is variable and is related to gas formation during coalification as well as the post-depositional history and the present geological condition of the coal bed.

Coalbed methane occurs in three main forms:

1. in fractures and void spaces called macropores;
2. adsorbed onto the molecular structure of coal in micropores; and,
3. absorbed into the molecular structure of coal.

Type 1 methane is released from coal intersected by diamond drilling before the core can be recovered for measurement of gas content but it can be recovered from the coal seam during gas production. For the purposes of reserve calculation, this is referred to as "lost gas" and the quantity can be estimated by a number of different methods. Type 2 methane, which usually accounts for most of the reservoir potential, is measured directly from drill core in the field. Type 3 methane is the residual component which can only be measured by crushing the core sample under confined conditions and measuring the gas released.

Production begins by pumping water from coal measures. This process lowers the pressure on the macropore gas and, eventually, on the adsorbed and absorbed gas which then begins to flow out of the micropore system into the macropore system and into the well bore. Generally, as pumping continues, production water volumes decline and gas volumes increase.

Single-zone completions are used in shallow coalfields. A completion is the depth in a drill hole at which gas is collected for production from surrounding bedrock. For deeper coal seams (more than 900 m from surface), multiple completions are used. Only coal seams thicker than 0.5 m are considered for completion and many coal seams can be completed per well. Open-hole completions are commonly used for single-seam wells, while multiple-seam completions may be open-hole or cased-hole where casing is perforated at individual production depths. Well spacing is usually about one per 20 or 25 hectares, or approximately 1500 m apart.

Water produced with the coalbed methane usually does not present a disposal problem unless it is brackish or contains unusually high amounts of coal fines.

The Alberta Geological Survey standard used for estimating coalbed methane potential is 13.5 cubic metres of gas per tonne of bituminous coal in seams greater than 0.5 m thick, half of which is considered to be recoverable. The well explored Warrior Basin in Alabama contains 32 billion tonnes of high volatile bituminous coal in seams ranging from 10 cm to 1 m thick. The estimated methane reserve is 1.1 trillion cubic metres which converts to 34.4 cubic metres of gas per tonne of coal, with about 38% of this currently recoverable. Recent work, however, indicates that as much as 80% of the gas in place may eventually be recovered. Using the Alberta Geological Survey method of estimation, recoverable coalbed methane potential of the 2.8 billion tonnes of possible coal in seams greater than 0.5 m thick in the Division Mountain coalfield is 17.5 billion cubic metres. If the best-case scenario of the Warrior Basin is applied, the recoverable coalbed methane potential of the Division Mountain field could be as high as 75 billion cubic metres. This compares to the seven billion cubic metre proven reserve of the Kotaneelee natural gas field in southeast Yukon.

Order-of-magnitude values are useful for comparisons between coal and coalbed methane as fuels. A tonne of coal mined and burned will theoretically provide about 60 times more energy than the associated methane extracted from the same one tonne of coal although, in practice, this ratio is generally lower as the end use efficiency for methane is generally much higher than that for coal. According to the British Columbia Geological Survey Branch, a single house using electricity derived from coal for all its energy needs requires from 1 to 5 tonnes of coal per year. If coalbed methane was used as a primary energy source, the coal requirement would be from 40 to 200 tonnes. A resource of 600 million tonnes of coal, which could contain 4 billion cubic metres of methane, is sufficient to provide all the energy consumption for up to 5000 Yukon homes for 100 years (assuming Yukon homes use 1.5 times as much energy as the average British Columbia home).

## 1991 TRENCHING PROGRAM

The 1991 trenching program was carried out between August 22 and 25, 1991 using an Hitachi UH09 tracked excavator under contract from E. Caron Diamond Drilling Ltd. of Whitehorse. The machine was transported by truck and trailer to Km 18 on the access road where muddy conditions prevented further travel. The excavator proceeded from this point under its own power for 10 km to the area of trenching.

Location of the 230 m long 1991 excavator trench is shown on Figure 6. The trenching was carried out along a 1972 bulldozer trail to minimize environmental impact. Overburden depth in the north half of the trench was greater than the 5 m depth capability of the machine. Unfortunately, this area overlies the extrapolated strike extension of the Cairnes Seam and no coal was intersected. Volume of material removed is estimated at 2200 cubic metres. The trench was backfilled and recontoured at completion of the work.

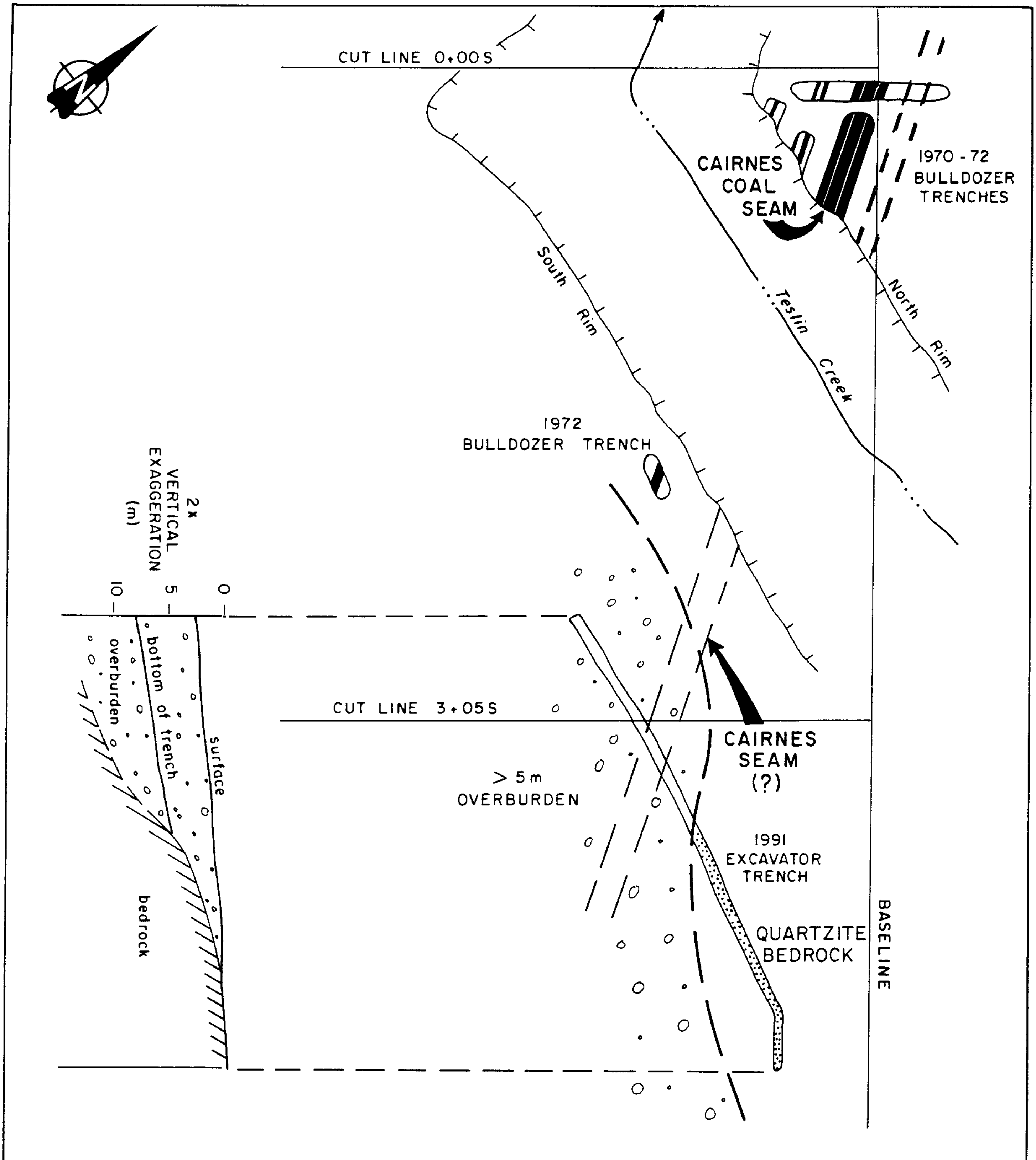



Figure 6

**ARCHER, CATHRO & ASSOCIATES (1981) LIMITED**

# TRENCH PLAN

## TESLIN CREEK AREA

## DIVISION MOUNTAIN COAL

### W4 JOINT VENTURE

1:2500

0 50 100m

0 100 200 300ft

# APPENDIX I

# AUTHOR'S STATEMENT OF QUALIFICATIONS

## STATEMENT OF QUALIFICATIONS

I, Robert C. Carne, geologist, with business addresses in Whitehorse, Yukon Territory and Vancouver, British Columbia and residential address in Burnaby, British Columbia, hereby certify that:

1. I graduated from the University of British Columbia in 1974 with a B.Sc. and in 1979 with an M.Sc. majoring in Geological Sciences.
2. I am a member of the Geological Association of Canada.
3. From 1974 to present, I have been actively engaged as a geologist in mineral exploration in British Columbia and Yukon Territory and on June 1, 1981 became a partner of Archer, Cathro & Associates (1981) Limited.
3. I have personally participated in or supervised the field work reported herein and have interpreted all data resulting from this work.

Robert C. Carne, B.Sc.,M.Sc.

# APPENDIX II

# LIST OF PERSONNEL

## LIST OF PERSONNEL

| NAME | POSITION | PERIOD |
|---|---|---|
| R. Carne | Geologist | August 22-25, December, 1991 and January, 1992 |
| C. Vig | Equipment Operator | August 22-25, 1991 |

# APPENDIX III

# COAL GEOCHEMISTRY AND PETROGRAPHY, DIVISION MOUNTAIN COAL OCCURRENCE; GSC PRELIMINARY REPORT OF INVESTIGATIONS

# COAL GEOCHEMISTRY AND PETROGRAPHY

# DIVISION MOUNTAIN COAL OCCURRENCE

PRELIMINARY REPORT OF INVESTIGATIONS

June 25, 1991

A.P. Beaton and A.R. Cameron

Geological Survey of Canada
Institute of Sedimentary and Petroleum Geology
3303 33rd St. N.W., Calgary, Alberta

## INTRODUCTION

The focus of this report is on the petrography and geochemistry of the main seam exposed by the 1970-1972 drilling and trenching operations of Arjay Kirker Resources Ltd.

The coal-bearing strata consist of interbedded sandstones and shales. It has been suggested that the coal measures lie within the Jurassic Laberge Group, disconformably overlain by Upper Jurassic - Lower Cretaceous Tantalus Formation sandstones and conglomerates.

Within the exploration trench, the seam appears to lie almost vertical, however, drill hole data from the 1972 program indicates a seam dip approximating 60 derees to the southwest. The seam consists of three main benches, separated by two clay and sand partings, 92 cm. and 54 cm. thick. The seam exposure, totalling 15.6 m in thickness, was sampled in detail to document changes in coal composition vertically within the seam (figure 1).

## METHODS

The coal seam was sampled for the most part in 50 cm. vertical increments, however, if a difference in coal lithology was observed, the sampling interval was adjusted accordingly. In addition, the floor, roof and partings were sampled. Figure 1 shows sample intervals.

The individual samples were crushed to pass through a 20 mesh sieve, and a representative sample was removed for microscopical analysis. The remaining sample was crushed to pass a 100 mesh sieve in preparation for chemical analysis.

The 20 mesh microscopical sample was cast into a pellet with a slow-setting epoxy, and subsequently ground and polished using standard techniques. Reflected white- and fluorescent light microscopy (in oil immersion) was used to determine maceral composition by point counting methods. Reflectance measurements were obtained on 5 representative samples for rank determination.

A representative sample of the 100 mesh split was used for ash, sulfur, and chemical analysis. Ash content was determined by calculating weight loss at 750 degrees C, following A.S.T.M. standards. Sulfur was determined with a LECO™ sulfur analyser. Major, minor and trace element concentrations were determined by instrumental neutron activation analysis (I.N.A.A.) for most elements, however, Sr and Nb were determined by DC plasma spectroscopy, and Ni, Cu, Pb, Li and Be were determined by atomic absorption analysis.

## RESULTS

### 1 COAL COMPOSITION BY OPTICAL MICROSCOPY

#### 1a) Rank - level of maturation

The rank of the coal has been determined on the coal by means of reflected light microscopy, the results easily correlated to traditional ultimate and proximate analyses. Several samples representing various stratigraphic positions within the coal seam were analysed. A total of 50 Rmax (maximum reflectance measurements) on vitrinite were averaged per sample, with a range across the seam from 0.60 - 0.65 %. A trend is observed, showing a slight increase in reflectance towards the base of the seam. These preliminary results place the coal at a rank of high volatile bituminous "B".

Variation in reflectance may be due in part to bitumen staining, as there is a range in the reflectivity of vitrinite in the seam. The rank of 0.6 % places the coal just above the first "coalification jump" (Stach et al, 1982)[1] where the lipid-rich plant -derived products within the coal (liptinites), and to a lesser extent the woody coal products (vitrinite), are thermally broken down, expelling some hydrocarbon products. This can result in an "oil stained" vitrinite, typically showing a lessened reflectance.

---

[1] Stach's Textbook of Coal Petrology, 1982.

1b) Maceral Composition

The maceral composition is shown on a mineral matter free (mmf) basis in figure 1, and on an "as received" basis in table 1. The vitrinite group macerals are the most abundant, showing a weighted seam average of 51.4 %. Two "types" of vitrinite are present, a clean, structureless, high-reflective type (type 1), and a slightly lesser-reflecting variety, often showing slight traces of original plant structures (type 2). A "groundmass" type of vitrinite is also present (desmocollinite), which contains liptinite and inertinite group macerals.

Desmocollinite is most common of the vitrinite group, accounting for up to 2/3 of the vitrinite. Vitrinite type 1 is also plentiful, whereas vitrinite type 2 occurs in lesser amounts. The samples higher in ash have greater amounts of desmocollinite; cleaner, lower - ash samples contain relatively more vitrinite type 1.

Macerals of the liptinite group comprise 12.4 % of the coal seam on a mmf, weighted average basis. Liptinite macerals are easily identified by their fluorescence properties in UV irradiation. Sporinite is the dominant liptinite, however significant amounts of resinite are present. Liptodetrinite and cutinite make up the remainder of the liptinites present. Traces of bituminite and alginite are also present, with the most frequent occurrences of both bituminite and alginite in the upper coal bench, and slightly lesser amounts of bituminite, but almost no alginite in the lower bench. The middle bench is almost devoid of bituminite and alginite.

There are indications that many of the liptinites are at the stage of thermal decomposition. Sporinite, resinite and cutinite show a wide range of fluorescent colour and intensity. There is no apparent trend to these variations. For example, resinite from one sample can show a range from bright yellow to dull brown under UV-illumination.

Inertinite group macerals average 36.2 % (mmf, wt.avg.) of the coal macerals. The inertinite macerals are derived from oxidation of woody plant tissues, and have a much greater reflectivity than the vitrinite macerals.

Two main types of inertinites are present, fusinite and semi-fusinite. The inertinite group actually represents a continous range or series above the level of unoxidised plant tissues (vitrinites), as evidenced by a slight increase in reflectance over vitrinite and slight pronunciation of original plant tissues (the maceral semi-fusinite) to much higher reflectances and commonly well defined original plant structures (fusinite).

The coal seam contains abundant semi-fusinite, and it is often difficult to distinguish low-reflecting semi-fusinite from vitrinite. Furthermore, there is some anisotropic fusinite (pyrolytic carbon), the char derived from ancient peat fires.

Mineral matter varies throughout the seam, however it does follow the ash composition closely (figure 1). The dominant minerals observed are clays and quartz, with minor amounts of carbonates (probably calcite). Large rounded masses of mineral are often observed, and are likely sideritic, or a sulfide mineral. Often, mineral matter occurs as finely disseminated particles within desmocollinite and massive resinites.

The upper and middle benches contains the cleanest coals, with a weighted average of 10 % mineral, and 17.5 % ash. The lower bench contains slightly higher mineral and ash contents, 19 % and 26 % respectively.

## 2 ELEMENTAL COMPOSITION

The elemental composition of the coal seam shows only a slight variation between samples, with the most variation directly associated with the ash content. The weighted average of elemental concentrations is presented in table 2. The weighted average represents the composite coal from the three benches in the seam section, and the most probable composition in a mined, well mixed product. This average does not include the major partings, but does include the minor (<3 cm.) partings that could not be efficiently removed during mining.

Most elements are associated with the mineral fraction of the coal; however there are some exceptions. Calcium, strontium and zinc are most concentrated in the low ash coal fraction (<40 % ash). The elements Mg, Na and V show highest concentrations in the medium-ash coals (40 -70 % ash).

On a whole coal (unashed) basis, most elements are present in concentrations less than the Clarke value (average concentration in the earth's crust). One of the exceptions to this is selenium, which has an average concentration of 0.6 ppm compared to a Clarke value of 0.1 ppm. Antimony, arsenic and boron are also found in concentrations greater than Clarke values (table 2). A sulfur content of 0.3 % is very low and an attractive feature of the coal.

## DISCUSSION

The coals from the main seam trench are of a high volatile bituminous B rank, as determined by reflected light microscopy. This rank assessment agrees with other petrographical data, including the presence of liptinites in various degrees of "maturation equilibrium", supression of reflectance in some vitrinite, and a wide range of fluorescent colours and intensity.

Previous work[2] reports a low calorific value of 9500 BTU/lb, which places the coal at a lower rank, as low as sub-bituminous.It is unclear if this value is on a mineral matter free basis, and indeed the high mineral matter and ash content of the seam would tend to suppress the heating value.

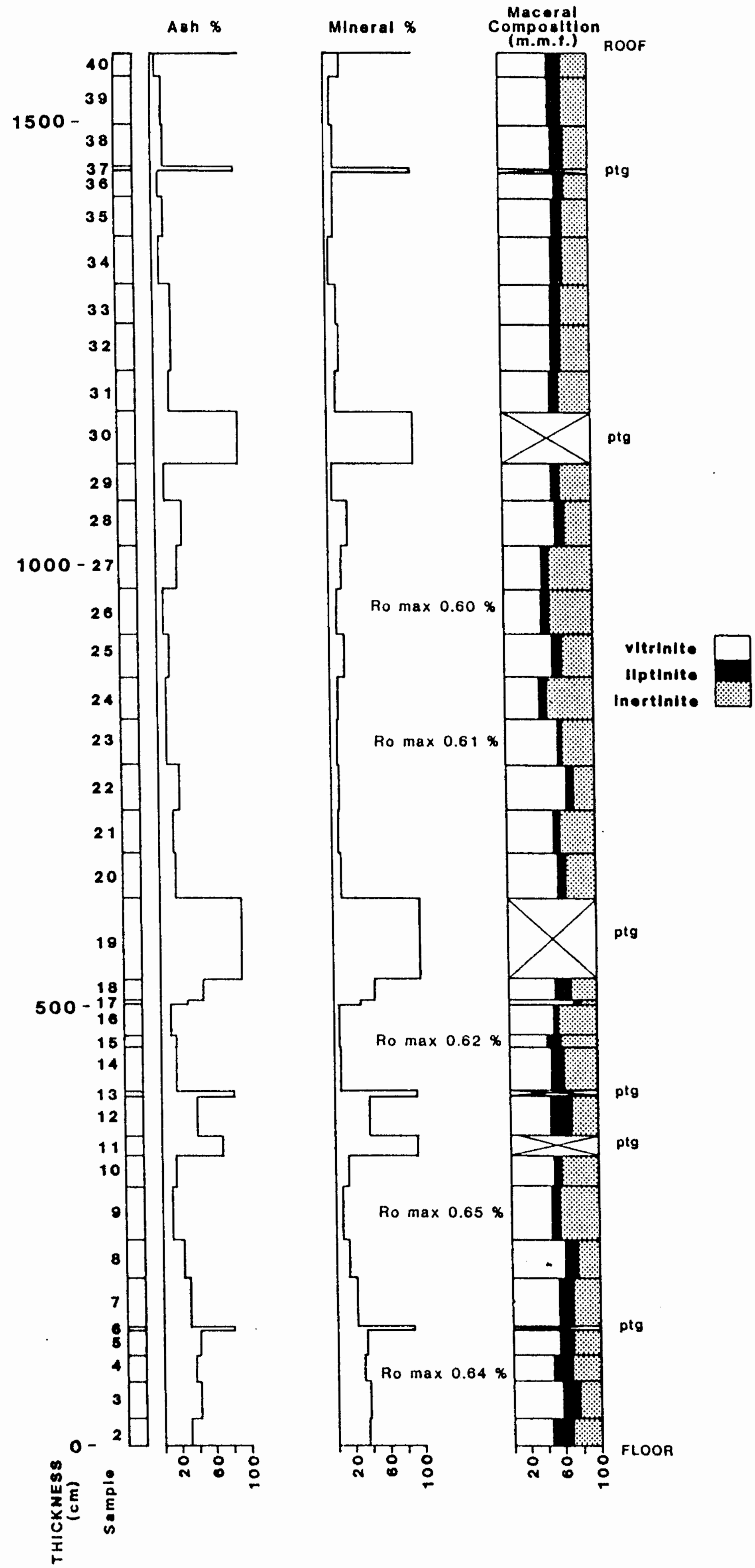
Petrographically, the coals contain much vitrinite and liptinites, but unfortunately, much mineral matter and inertinites. The low reflecting semifusinite, common in the seam, may indeed be reactive and contribute substantially in combustion processes. Furthermore, there is a dominance of desmocollinite, and the coal in general has a fractured, allocthonous or detrital nature to it.

The high concentration of liptinites associated with a high volatile rank of coal, and the relatively porous nature of the coal warrants investigation into coalbed methane and "oil - from - coal" potential.

---

[2] R.C. Carne, Summary Report on the Division Mountain Coal Prospect. Archer Cathro and Associates Ltd. 1990.

FIGURE 1




DIVISION MOUNTAIN
COAL PROJECT

TABLE 1 - EXPLANATION OF ABBREVIATED HEADINGS:

**VITRINITE GROUP MACERALS**

VIT. type 1 - bright homogenous vitrinite; see text

VIT. type 2 - darker vitrinite, showing faint structure; see text

DESMO. - Desmocollinite; groundmass vitrinite, containing liptinite and inertinite.

V.DET - vitrodetrinite

TOT. V - total amount of vitrinite group macerals

**LIPTINITE GROUP MACERALS**

SPOR. - sporinite

CUT. - cutinite

RESIN - resinite

L.DET - liptodetrinite

TOT.L - total amount of liptinite group macerals

**INERTINITE GROUP MACERALS**

SEMIFUS - semifusinite

FUS. - fusinite

I.DET - inertodetrinite

TOT.I - total amount of inertinite group macerals

Bt - bituminite

Al - alginite

MIN. - mineral matter

ASH % - ash content determined at 750° C

DIVISION MOUNTAIN, YUKON TERRITORY MACERAL ANALYSIS, volume %. TABLE 1

| | THK. | SAMP. CQ-760- | VIT. type 1 | VIT. type 2 | DESMO | V.DET | TOT.V | SPOR. | CUT. | RESIN. | L.DET | TOT.L | SEMIFUS | FUS. | I.DET | TOT.I | Bt* | Al* | MIN. | ASH % |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 41 | ROOF | | | | | | | | | | | | | | | | ROOF | 83.73 |
| *** | 29 | 40 | 19.8 | 5.6 | 13.8 | 3.6 | 42.8 | 3.8 | 2.4 | 1.2 | 4 | 11.4 | 5 | 18 | 4.2 | 27.2 | 7 | 1 | 18.6 | 8.29 |
| | 50 | 39 | 20.2 | 4 | 25.2 | 1.6 | 51 | 6 | 2.8 | 1.4 | 4 | 14.2 | 5 | 20 | 4.2 | 29.2 | 3 | | 5.6 | 15.88 |
| | 50 | 38 | 27 | 4 | 21.2 | 1 | 53.2 | 5.8 | 0.8 | 4.4 | 4 | 15 | 4 | 18 | 2.6 | 24.6 | 2 | 1 | 7.2 | 16.64 |
| TOT | 27 | 36 | 19.2 | 2.6 | 32.4 | 0.8 | 55 | 5.8 | 0.8 | 1.2 | 2.2 | 10 | 5 | 19.6 | 1.8 | 26.4 | 2 | | 8.6 | 13.88 |
| 406 | 50 | 35 | 18.6 | 3.8 | 30.6 | 0.8 | 53.8 | 4.8 | 1.8 | 3 | 2.8 | 12.4 | 2.8 | 20.6 | 2.2 | 25.6 | 1 | | 8.2 | 16.7 |
| cm. | 50 | 34 | 17.4 | 4 | 32.8 | 0.8 | 55 | 5 | 1.2 | 0.8 | 3.4 | 10.4 | 12.8 | 16.6 | 1.4 | 30.8 | 1 | | 3.8 | 13.45 |
| | 50 | 33 | 19.8 | 2.6 | 24.6 | 1.8 | 48.8 | 4.4 | 0 | 1.2 | 1.8 | 7.4 | 11.2 | 17 | 3.2 | 31.4 | 3 | | 12.4 | 20.33 |
| | 50 | 32 | 20.6 | 3 | 23 | 1.6 | 48.2 | 3.8 | 0.8 | 1.2 | 1.4 | 7.2 | 6 | 22.6 | 1.6 | 30.2 | 1 | 1 | 14.4 | 20.24 |
| *** | 50 | 31 | 22.7 | 4.7 | 14.7 | 2.7 | 44.8 | 5.5 | 1.7 | 3 | 1.7 | 11.9 | 5.5 | 27 | 1.5 | 34 | 2 | 1 | 9.3 | 17.99 |
| wt.avg. | | | 20.7 | 3.8 | 24.3 | 1.6 | 50.4 | 5.0 | 1.3 | 2.0 | 2.8 | 11.1 | 6.5 | 20.1 | 2.5 | 29.0 | | | 9.4 | 16.4 |
| *** | 43 | 29 | 22 | 3.5 | 22 | 1.7 | 49.2 | 5.5 | 0.7 | 1.5 | 1.2 | 8.9 | 6.7 | 28.2 | 1.7 | 36.6 | | | 5.3 | 14.79 |
| | 50 | 28 | 14.2 | 2.7 | 24.7 | 1 | 42.6 | 4.5 | 0.5 | 2.5 | 2.2 | 9.7 | 1.5 | 21.5 | 3.2 | 26.2 | 2 | | 21.5 | 30.64 |
| | 50 | 27 | 11.2 | 2.2 | 21.2 | 0.2 | 34.8 | 5 | 1 | 2.7 | 1 | 9.7 | 5.5 | 33 | 2.5 | 41 | | | 14.5 | 23.19 |
| TOT | 50 | 26 | 8.7 | 1.2 | 26.5 | 0.5 | 36.9 | 6.5 | 0.7 | 1.7 | 2 | 10.9 | 6.7 | 36 | 2 | 44.7 | | | 7.5 | 14.02 |
| 493 | 50 | 25 | 14.5 | 2.7 | 22.2 | 0 | 39.4 | 7.7 | 1.5 | 1.2 | 1.2 | 11.6 | 3 | 26.5 | 1.7 | 31.2 | 2 | | 17.8 | 18.4 |
| cm. | 50 | 24 | 11.5 | 1.5 | 21.7 | 0 | 34.7 | 4 | 0.7 | 2 | 0.7 | 7.4 | 10.5 | 38.5 | 1.2 | 50.2 | | | 7.7 | 14.22 |
| | 50 | 23 | 15.5 | 8.2 | 26.5 | 1.5 | 51.7 | 3.2 | 1 | 1.2 | 1.2 | 6.6 | 6 | 24.7 | 4.7 | 35.4 | | | 6.3 | 11.77 |
| | 50 | 22 | 25.2 | 12.7 | 19.7 | 0.2 | 57.8 | 4.2 | 1.7 | 1.5 | 1.2 | 8.6 | 3 | 18.2 | 2.7 | 23.9 | | | 9.7 | 22.72 |
| | 50 | 21 | 15 | 5.2 | 25.2 | 0.7 | 46.1 | 5.5 | 0.2 | 2.2 | 1 | 8.9 | 6 | 30.2 | 2 | 38.2 | | | 6.8 | 16.75 |
| *** | 50 | 20 | 16.7 | 3.2 | 29.2 | 0.5 | 49.6 | 5.5 | 0.7 | 1 | 1.7 | 8.9 | 8.7 | 21.2 | 1.5 | 31.4 | | | 10.1 | 20.58 |
| wt.avg | | | 15.4 | 4.3 | 23.9 | 0.6 | 44.2 | 5.2 | 0.9 | 1.8 | 1.3 | 9.1 | 5.7 | 27.8 | 2.3 | 35.9 | | | 10.8 | 18.8 |
| *** | 24 | 18 | 8 | 5.2 | 9.2 | 3 | 25.4 | 7.5 | 1 | 1 | 3.7 | 13.2 | 1.7 | 10.5 | 2 | 14.2 | | | 47.2 | 47.22 |
| TOT | 3 | 17 | 33.2 | 4.2 | 15 | 0 | 52.4 | 3.2 | 0 | 0.2 | 0.5 | 3.9 | 3.7 | 9.2 | 1 | 13.9 | | | 29.8 | 31.89 |
| 127 | 36 | 16 | 24 | 3.5 | 17.2 | 1 | 45.7 | 3.5 | 0.5 | 1 | 1.5 | 6.5 | 3.7 | 37.5 | 1.7 | 42.9 | | | 4.9 | 13.77 |
| cm. | 10 | 15 | 15 | 2.2 | 20.7 | 0 | 37.9 | 10 | 1.7 | 1.7 | 2.2 | 15.6 | 6.5 | 32 | 1.7 | 40.2 | | | 6.3 | 19.52 |
| *** | 54 | 14 | 15 | 2 | 24.2 | 1.2 | 42.4 | 7.5 | 1.2 | 1.2 | 2.5 | 12.4 | 4.7 | 27.5 | 4.2 | 36.4 | | | 8.8 | 19.39 |
| wt.avg | | | 16.7 | 3.1 | 18.9 | 1.4 | 40.0 | 6.5 | 1.0 | 1.1 | 2.4 | 10.9 | 4.0 | 27.0 | 2.8 | 33.8 | | | 15.3 | 23.4 |
| *** | 40 | 10 | 16.7 | 1.5 | 19.7 | 0.2 | 38.1 | 6.7 | 1 | 1 | 1.2 | 9.9 | 2 | 30.2 | 2 | 34.2 | | | 17.8 | 18.95 |
| | 50 | 09 | 7 | 4.5 | 29.5 | 0 | 41 | 6.5 | 0 | 2.2 | 1 | 9.7 | 2.7 | 36.7 | 1 | 40.4 | | | 8.9 | 13.31 |
| | 50 | 08 | 19.2 | 7.2 | 24.2 | 0 | 50.6 | 7.5 | 0.2 | 2.5 | 4 | 14.2 | 2.2 | 14.2 | 3 | 19.4 | 2 | | 15.8 | 24.2 |
| TOT | 50 | 07 | 7.2 | 8.2 | 23.7 | 0.5 | 39.6 | 8.7 | 1.7 | 1.2 | 0.7 | 12.3 | 3.5 | 15.5 | 4.7 | 23.7 | 2 | | 24.4 | 31.06 |
| 324 | 32 | 05 | 8.7 | 10.5 | 15 | 1.2 | 35.4 | 5.5 | 0.7 | 0.7 | 3.5 | 10.4 | 2.2 | 18 | 1.5 | 21.7 | 3 | 1 | 32.5 | 41.4 |
| cm. | 28 | 04 | 6.2 | 6.2 | 16.5 | 2.2 | 31.1 | 9.7 | 2.7 | 0.7 | 2 | 15.1 | 3.2 | 20 | 2.5 | 25.7 | 1 | | 28.1 | 37.72 |
| | 44 | 03 | 7.5 | 9.5 | 14.5 | 3.2 | 34.7 | 7.5 | 0.7 | 1 | 2 | 11.2 | 3 | 11.7 | 1.7 | 16.4 | 1 | | 37.7 | 40.85 |
| *** | 30 | 02 | 3.7 | 10.5 | 10 | 2 | 26.2 | 10 | 0.5 | 1.5 | 2.2 | 14.2 | 1.7 | 18 | 3.5 | 23.2 | 6 | | 36.4 | 33.52 |
| wt.avg | | | 10.0 | 7.1 | 20.2 | 1.0 | 38.3 | 7.7 | 0.9 | 1.4 | 2.0 | 12.0 | 2.6 | 20.7 | 2.5 | 25.8 | | | 23.9 | 28.9 |
| | | 01 | FLOOR | | | | | | | | | | | | | | | | | |

( * Bt, Al - expressed # of observations in 500 counts, included in liptodetrinite (L.DET).

DIVISION MOUNTAIN ELEMENTAL COMPOSITION SUMMARY TABLE 2

(all values in ppm.)

| | WHOLE SEAM WEIGHTED AVERAGE | Clarke Value * | Low Ash Coals | Medium Ash Coals | High Ash Samples |
|---|---|---|---|---|---|
| ASH % | 21.8 | | 20.5 | 48.1 | 84.8 |
| S % | 0.3 | | 0.3 | 0.3 | 0.03 |
| Al | 39409 | 81000 | 34880 | 81560 | 150571 |
| Ba | 269 | 425 | 260 | 462 | 773 |
| Ca | 21792 | 36000 | 25948 | 14474 | 3445 |
| Fe | 7940 | 50000 | 8152 | 8560 | 14679 |
| Mg | 2571 | 21000 | 2647 | 3706 | 1784 |
| K | 1244 | 30000 | 1183 | 3818 | 10886 |
| Na | 818 | 28000 | 812 | 3646 | 1682 |
| Ti | 2338 | 4400 | 2079 | 4858 | 5583 |
| Sb | 0.5 | 0.2 | 0.5 | 1 | 0.6 |
| As | 3 | 1.8 | 3 | 7 | 5 |
| B | 49 | 10 | 47 | 60 | 72 |
| Be | 1 | - | 0.9 | 1.8 | 1.9 |
| Br | 2 | 3 | 2 | 2 | 1 |
| Cs | 0.3 | 3 | 0.4 | 0.7 | 1.6 |
| Cl | 22 | 130 | 22 | 23 | 27 |
| Cr | 12 | 100 | 11 | 30 | 84 |
| Co | 3 | 25 | 3 | 4 | 5 |
| Cu | 25 | 55 | 22 | 32 | 40 |
| Hf | 2 | 3 | 2 | 5 | 6 |
| Pb | 8 | - | 6 | 12 | 21 |
| Li | 9 | - | 7 | 19 | 29 |
| Mn | 130 | 950 | 135 | 140 | 207 |
| Mo | 0.5 | 1.5 | 0.6 | 0.7 | 8 |
| Ni | 6 | 75 | 4 | 10 | 69 |
| Nb | 10 | 20 | 8 | 19 | 28 |
| Rb | 7 | 90 | 7 | 16 | 39 |
| Sc | 8 | 22 | 7 | 14 | 13 |
| Se | 0.6 | 0.1 | 0.6 | 0.7 | 0.8 |
| Sr | 350 | 375 | 397 | 239 | 201 |
| Ta | 0.2 | 2 | 0.2 | 0.5 | 0.9 |
| Th | 2 | 7 | 2 | 4 | 7 |
| W | 0.5 | 1.5 | 0.5 | 1 | 1.8 |
| U | 1 | 1.8 | 1 | 2 | 4 |
| V | 47 | 135 | 43 | 100 | 89 |
| Zn | 72 | - | 68 | 9 | 28 |
| Ce | 18 | 60 | 16 | 33 | 40 |
| Dy | 3 | 3 | 3 | 5 | 4 |
| Eu | 0.5 | 1.2 | 0.5 | 0.9 | 0.9 |
| Ho | 0.5 | 1.2 | 0.4 | 0.8 | 0.8 |
| La | 9 | 3 | 8 | 17 | 19 |
| Lu | 0.2 | 0.5 | 0.2 | 0.4 | 0.3 |
| Nd | 8 | 28 | 7 | 15 | 18 |
| Pr | 2 | - | 2 | 5 | 9 |
| Sm | 2 | 6 | 2 | 4 | 4 |
| Tb | 0.3 | - | 0.3 | 0.6 | 0.5 |
| Tm | 0.2 | 0.5 | 0.2 | 0.4 | 0.3 |
| Yb | 1.3 | 3.5 | 1.2 | 2.3 | 1.6 |

* from Mason and Moore, Geochemistry, 1982.

## DIVISION MOUNTAIN ELEMENTAL COMPOSITION (all values in ppm.)

| SAMPLE | THK. | TOT.THK | ASH % | S % | Al | Ba | Ca | Fe | Mg | K | Na | Ti | Sb | As | B | Be | Br | Cs |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CQ-760-041 | >5 | | 83.73 | 0.04 | 136000 | 1180 | 2330 | 7760 | 1940 | 15700 | 961 | 4740 | 0.55 | 4.75 | 49.7 | 2.1 | 0.9 | 2.67 |
| CQ-760-040 | 29 | 1577 | 8.29 | 0.33 | 78600 | 292 | 12200 | 5030 | 1860 | 2740 | 450 | 3340 | 0.92 | 4.19 | 52.8 | 2 | 1.58 | 1.39 |
| CQ-760-039 | 50 | 1548 | 15.88 | 0.37 | 27700 | 514 | 16700 | 3920 | 2030 | 1910 | 499 | 1220 | 0.37 | 2.4 | 48.4 | 0.6 | 2.49 | 0.15 |
| CQ-760-038 | 50 | 1498 | 16.64 | 0.31 | 29900 | 149 | 20800 | 7190 | 2530 | 1160 | 505 | 1270 | 0.61 | 2.15 | 45.9 | 0.7 | 2.09 | 0.18 |
| CQ-760-037 | 3 | 1448 | 83.62 | 0.02 | 181000 | 260 | 2910 | 8480 | 1790 | 4200 | 642 | 10400 | 0.53 | 5.1 | 103.4 | 1.7 | 0.47 | 0.42 |
| CQ-760-036 | 27 | 1445 | 13.88 | 0.31 | 17600 | 275 | 28500 | 12700 | 3110 | 750 | 442 | 987 | 0.41 | 1.56 | 34.6 | 1 | 1.67 | 0.22 |
| CQ-760-035 | 50 | 1418 | 16.7 | 0.35 | 28400 | 216 | 30300 | 10100 | 2750 | 540 | 567 | 1780 | 0.41 | 1.88 | 47.1 | 0.5 | 2.56 | 0.29 |
| CQ-760-034 | 50 | 1368 | 13.45 | 0.29 | 16900 | 531 | 27300 | 14300 | 2810 | 1100 | 945 | 1200 | 0.25 | 1.31 | 36.9 | 0.5 | 3.54 | 0.27 |
| CQ-760-033 | 50 | 1318 | 20.33 | 0.25 | 26800 | 478 | 24200 | 17300 | 3380 | 1700 | 1690 | 1600 | 0.6 | 1.66 | 38.2 | 0.6 | 2.73 | 0.38 |
| CQ-760-032 | 50 | 1268 | 20.24 | 0.28 | 31700 | 234 | 32500 | 9160 | 4310 | 1370 | 1410 | 1470 | 0.39 | 2.01 | 52.6 | 0.5 | 3.51 | 0.38 |
| CQ-760-031 | 50 | 1218 | 17.99 | 0.35 | 24100 | 340 | 35100 | 8140 | 3470 | 780 | 727 | 1310 | 0.27 | 1.6 | 48.4 | 0.5 | 4.2 | 0.18 |
| CQ-760-030 | 54 | 1168 | 84.84 | 0.04 | 136000 | 870 | 8040 | 56200 | 1600 | 11000 | 2880 | 4780 | 0.75 | 7.34 | 54 | 2.3 | 1.2 | 1.99 |
| CQ-760-029 | 43 | 1114 | 14.79 | 0.45 | 20800 | 120 | 18900 | 4910 | 2540 | 570 | 703 | 1280 | 0.79 | 2.91 | 22.9 | 1.6 | 1.99 | 0.17 |
| CQ-760-028 | 50 | 1071 | 30.64 | 0.32 | 87300 | 266 | 28000 | 5370 | 3700 | 1790 | 1420 | 3370 | 0.5 | 3.08 | 58.6 | 1.2 | 2.78 | 0.39 |
| CQ-760-027 | 50 | 1021 | 23.19 | 0.28 | 55100 | 154 | 30800 | 8660 | 2540 | 1020 | 624 | 2330 | 0.66 | 1.43 | 55 | 0.9 | 2.25 | 0.33 |
| CQ-760-026 | 50 | 971 | 14.02 | 0.31 | 20300 | 184 | 17300 | 8280 | 1970 | 380 | 665 | 2680 | 0.21 | 1.5 | 36.8 | 0.6 | 1.79 | 0.15 |
| CQ-760-025 | 50 | 921 | 18.4 | 0.34 | 29700 | 163 | 19300 | 6560 | 1440 | 763 | 782 | 1520 | 0.37 | 1.35 | 57.2 | 0.5 | 2.53 | 0.22 |
| CQ-760-024 | 50 | 871 | 14.22 | 0.3 | 24100 | 250 | 17800 | 7320 | 1160 | 380 | 619 | 1730 | 0.19 | 1.21 | 40.9 | 0.5 | 1.86 | 0.15 |
| CQ-760-023 | 50 | 821 | 11.77 | 0.35 | 18000 | 207 | 19000 | 4270 | 1420 | 479 | 466 | 908 | 0.32 | 1.21 | 39.4 | 0.5 | 1.2 | 0.11 |
| CQ-760-022 | 50 | 771 | 22.72 | 0.33 | 43100 | 237 | 31600 | 16500 | 1300 | 910 | 751 | 2310 | 0.55 | 2.09 | 63 | 1.1 | 1.64 | 0.5 |
| CQ-760-021 | 50 | 721 | 16.75 | 0.37 | 27000 | 282 | 17000 | 6300 | 1490 | 520 | 617 | 1510 | 0.29 | 1.71 | 45.4 | 0.6 | 1.37 | 0.14 |
| CQ-760-020 | 50 | 671 | 20.58 | 0.36 | 33200 | 159 | 15200 | 9460 | 1740 | 965 | 824 | 2120 | 0.37 | 2.08 | 48.3 | 0.7 | 1.56 | 0.32 |
| CQ-760-019 | 92 | 621 | 88 | 0.02 | 131000 | 1110 | 4550 | 15300 | 2510 | 16300 | 2900 | 4350 | 0.58 | 3.92 | 60.3 | 1.9 | 0.69 | 2.22 |
| CQ-760-018 | 24 | 529 | 47.22 | 0.21 | 93900 | 347 | 16700 | 6610 | 2270 | 1740 | 666 | 7440 | 0.82 | 15.2 | 56.3 | 2.4 | 1.27 | 0.55 |
| CQ-760-017 | 3 | 505 | 31.89 | 0.3 | 11000 | 274 | 134000 | 16200 | 3810 | 320 | 407 | 600 | 0.62 | 3.3 | 27.2 | 0.9 | 3.13 | 0.17 |
| CQ-760-016 | 36 | 502 | 13.77 | 0.33 | 14200 | 176 | 35200 | 5880 | 2740 | 637 | 387 | 644 | 0.18 | 2.18 | 29.4 | 0.7 | 1.52 | 0.13 |
| CQ-760-015 | 10 | 466 | 19.68 | 0.34 | 27800 | 227 | 20700 | 6230 | 2340 | 1230 | 771 | 1720 | 0.42 | 2.39 | 45.6 | 0.5 | 1.48 | 0.3 |
| CQ-760-014 | 54 | 456 | 19.43 | 0.32 | 31600 | 221 | 19600 | 10900 | 2620 | 839 | 392 | 1990 | 0.52 | 2.27 | 46.9 | 1 | 1.08 | 0.14 |
| CQ-760-013 | 10 | 402 | 82.85 | 0.06 | 172000 | 279 | 3040 | 5530 | 1660 | 5000 | 1150 | 5640 | 0.37 | 4.17 | 79.4 | 1.4 | 0.6 | 0.75 |
| CQ-760-012 | 40 | 392 | 41.58 | 0.21 | 85400 | 303 | 14300 | 8540 | 2970 | 2210 | 979 | 5350 | 0.61 | 2.54 | 75.7 | 1.4 | 1.84 | 0.4 |
| CQ-760-011 | 25 | 352 | 69.65 | 0.19 | 72500 | 779 | 20300 | 17100 | 8120 | 10000 | 14200 | 3130 | 0.67 | 5.94 | 31 | 1.8 | 1.8 | 1.25 |
| CQ-760-010 | 40 | 327 | 18.95 | 0.32 | 30300 | 248 | 31000 | 7760 | 4420 | 1250 | 1100 | 2530 | 0.37 | 2.37 | 53.4 | 0.5 | 2.45 | 0.43 |
| CQ-760-009 | 50 | 287 | 13.31 | 0.36 | 17900 | 208 | 22200 | 5760 | 3240 | 440 | 604 | 1780 | 0.21 | 2.2 | 34.8 | 0.5 | 2.35 | 0.17 |
| CQ-760-008 | 50 | 237 | 24.2 | 0.42 | 46000 | 185 | 12600 | 5430 | 2550 | 1180 | 596 | 2650 | 0.58 | 2.15 | 56.4 | 0.8 | 2.06 | 0.49 |
| CQ-760-007 | 50 | 187 | 31.06 | 0.39 | 55900 | 258 | 11600 | 3740 | 2380 | 2320 | 681 | 3620 | 0.8 | 2.65 | 73.2 | 1.1 | 2.66 | 0.68 |
| CQ-760-006 | 3 | 137 | 80.49 | 0.06 | 168000 | 323 | 1850 | 4720 | 1350 | 4000 | 872 | 4830 | 0.55 | 3.56 | 105.5 | 2 | 0.81 | 0.76 |
| CQ-760-005 | 32 | 134 | 41.4 | 0.34 | 81100 | 553 | 7870 | 5140 | 1980 | 2610 | 895 | 4200 | 1.49 | 6.6 | 75.4 | 1.6 | 3.6 | 0.43 |
| CQ-760-004 | 28 | 102 | 37.72 | 0.39 | 54600 | 281 | 5850 | 5460 | 1310 | 2090 | 742 | 5420 | 1.21 | 13.2 | 50.2 | 2.4 | 2.43 | 0.54 |
| CQ-760-003 | 44 | 74 | 40.85 | 0.36 | 74900 | 327 | 13200 | 5410 | 3190 | 2530 | 1490 | 4170 | 1.37 | 4.59 | 62.3 | 1.7 | 2.15 | 0.85 |
| CQ-760-002 | 30 | 30 | 33.52 | 0.46 | 41900 | 336 | 30000 | 6320 | 5270 | 2830 | 2480 | 3320 | 1.36 | 5.77 | 44.4 | 1.8 | 2.94 | 0.76 |
| CQ-760-001 | >5 | 0 | 90.11 | 0.01 | 130000 | 1390 | 1400 | 4760 | 1640 | 20000 | 2370 | 4340 | 0.63 | 4.96 | 48.6 | 2.1 | 0.35 | 2.25 |

| SAMPLE | Cl | Cr | Co | Cu | Hf | Pb | Li | Mn | Mo | Ni | Nb | Rb | Sc | Se | Sr | Ta | Th |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CQ-760-041 | 17 | 179 | 5.94 | 55 | 3.39 | 22 | 36 | 34.7 | 21.8 | 84 | 35 | 53.2 | 12 | 0.75 | 222 | 0.47 | 3.65 |
| CQ-760-040 | 26 | 22.4 | 3.25 | 43 | 1.78 | 13 | 20 | 18.1 | 0.56 | 7 | 19 | 11 | 10.9 | 0.63 | 678 | 0.31 | 3.23 |
| CQ-760-039 | 25 | 11.8 | 2.41 | 13 | 1.2 | 5 | 5 | 27.7 | 0.5 | 3 | 7 | 8.8 | 5.63 | 0.41 | 905 | 0.16 | 1.25 |
| CQ-760-038 | 24 | 9.14 | 1.94 | 16 | 1.28 | 5 | 4 | 115 | 0.37 | 3 | 9 | 6 | 5.31 | 0.47 | 222 | 0.15 | 1.23 |
| CQ-760-037 | 19 | 16.2 | 1 | 23 | 9.49 | 24 | 25 | 54.6 | 0.81 | 10 | 33 | 22.3 | 21 | 0.57 | 383 | 0.88 | 10.5 |
| CQ-760-036 | 22 | 4.35 | 2.25 | 17 | 0.97 | 4 | 3 | 228 | 0.48 | 2 | 6 | 6 | 6.4 | 0.5 | 820 | 0.04 | 0.93 |
| CQ-760-035 | 26 | 7.88 | 1.9 | 18 | 1.14 | 5 | 6 | 186 | 0.63 | 2 | 8 | 3.2 | 7.4 | 0.65 | 316 | 0.11 | 1.29 |
| CQ-760-034 | 19 | 8.21 | 2.04 | 15 | 0.88 | 6 | 2 | 354 | 0.5 | 4 | 2 | 6.3 | 4.08 | 0.78 | 1189 | 0.11 | 0.99 |
| CQ-760-033 | 36 | 13.4 | 2.77 | 15 | 1.74 | 6 | 6 | 374 | 0.53 | 5 | 9 | 8.6 | 6.98 | 0.49 | 942 | 0.17 | 1.78 |
| CQ-760-032 | 19 | 12.1 | 3.24 | 13 | 1.4 | 6 | 6 | 179 | 0.94 | 4 | 7 | 6.4 | 5.12 | 0.56 | 291 | 0.23 | 2.32 |
| CQ-760-031 | 24 | 10.3 | 3.15 | 14 | 0.85 | 4 | 4 | 166 | 0.45 | 2 | 4 | 4.9 | 6 | 0.88 | 517 | 0.09 | 0.79 |
| CQ-760-030 | 73 | 79.1 | 11.5 | 62 | 3.49 | 20 | 19 | 1090 | 4.38 | 35 | 47 | 48.8 | 19.7 | 1 | 204 | 0.44 | 3.59 |
| CQ-760-029 | 31 | 7.12 | 3.69 | 35 | 0.97 | 6 | 5 | 41.2 | 1.2 | 3 | 9 | 4.1 | 7.6 | 0.69 | 271 | 0.11 | 1.38 |
| CQ-760-028 | 43 | 11.7 | 3.15 | 15 | 3.04 | 7 | 10 | 78.5 | 0.6 | 5 | 18 | 11 | 7.82 | 0.58 | 249 | 0.56 | 4.89 |
| CQ-760-027 | 28 | 7.96 | 2 | 11 | 1.65 | 6 | 8 | 171 | 0.43 | 3 | 11 | 5.9 | 6.64 | 0.43 | 240 | 0.17 | 1.39 |
| CQ-760-026 | 20 | 7.39 | 1.78 | 13 | 1.09 | 5 | 4 | 107 | 0.39 | 4 | 9 | 4.1 | 6.47 | 0.43 | 215 | 0.17 | 1.29 |
| CQ-760-025 | 27 | 12.8 | 1.96 | 16 | 1.19 | 6 | 5 | 75.5 | 0.35 | 4 | 10 | 4.1 | 5.33 | 0.39 | 223 | 0.15 | 1.45 |
| CQ-760-024 | 32 | 9.37 | 1.86 | 17 | 1.12 | 5 | 3 | 105 | 0.38 | 3 | 9 | 2.5 | 7.07 | 0.33 | 474 | 0.12 | 1.36 |
| CQ-760-023 | 14 | 18 | 2.48 | 16 | 0.96 | 3 | 3 | 56.3 | 0.32 | 3 | 3 | 2.7 | 3.55 | 0.35 | 213 | 0.13 | 1.34 |
| CQ-760-022 | 22 | 12.5 | 3.7 | 27 | 1.54 | 6 | 5 | 357 | 0.52 | 3 | 6 | 6.2 | 8.36 | 1 | 464 | 0.22 | 1.77 |
| CQ-760-021 | 25 | 9.7 | 3.43 | 24 | 0.89 | 4 | 5 | 68.6 | 0.43 | 3 | 6 | 3.7 | 7.08 | 0.39 | 480 | 0.12 | 1.58 |
| CQ-760-020 | 14 | 10 | 3.38 | 36 | 1.22 | 5 | 7 | 135 | 0.4 | 3 | 7 | 5.5 | 7.5 | 1 | 187 | 0.19 | 2.26 |
| CQ-760-019 | 23 | 81.5 | 4.76 | 61 | 3.59 | 16 | 33 | 153 | 4.68 | 31 | 15 | 52 | 12.7 | 0.75 | 199 | 0.54 | 3.05 |
| CQ-760-018 | 11 | 27.8 | 5.32 | 61 | 3.02 | 11 | 21 | 79.4 | 0.55 | 11 | 31 | 8 | 21.2 | 0.85 | 146 | 0.31 | 2.53 |
| CQ-760-017 | 31 | 7.14 | 2.92 | 13 | 0.58 | 8 | 2 | 322 | 2.96 | 4 | 4 | 3.3 | 7.22 | 0.61 | 704 | 0.02 | 0.22 |
| CQ-760-016 | 8.8 | 5.18 | 3.33 | 12 | 0.62 | 5 | 3 | 92.4 | 0.33 | 2 | 4 | 3.3 | 5.35 | 0.47 | 369 | 0.06 | 0.61 |
| CQ-760-015 | 9 | 8.88 | 3.19 | 23 | 1.21 | 6 | 5 | 76.4 | 0.39 | 3 | 5 | 5.1 | 7.83 | 0.75 | 174 | 0.14 | 1.68 |
| CQ-760-014 | 26 | 6.03 | 2.81 | 16 | 2.07 | 5 | 5 | 203 | 0.38 | 2 | 6 | 7.7 | 6 | 0.53 | 155 | 0.27 | 2.64 |
| CQ-760-013 | 21 | 13 | 1.76 | 21 | 7.36 | 24 | 18 | 64.5 | 3.83 | 3 | 19 | 19.6 | 5.42 | 1 | 112 | 1.65 | 11.6 |
| CQ-760-012 | 11 | 9.09 | 2.12 | 20 | 5.95 | 16 | 15 | 161 | 0.59 | 3 | 17 | 8 | 12.9 | 0.62 | 101 | 0.65 | 4.18 |
| CQ-760-011 | 67 | 79.5 | 6.63 | 25 | 2.64 | 12 | 17 | 349 | 0.77 | 26 | 33 | 39.2 | 9.43 | 0.53 | 400 | 0.42 | 3.29 |
| CQ-760-010 | 22 | 8.55 | 4.71 | 40 | 1.05 | 4 | 6 | 123 | 0.48 | 2 | 8 | 5.2 | 8.78 | 0.57 | 300 | 0.12 | 1.22 |
| CQ-760-009 | 17 | 6.26 | 4.61 | 22 | 0.9 | 4 | 3 | 75.6 | 0.51 | 2 | 6 | 2.5 | 5.97 | 0.59 | 282 | 0.14 | 1.16 |
| CQ-760-008 | 17 | 8.72 | 4.76 | 32 | 2.11 | 11 | 10 | 58.9 | 0.63 | 2 | 11 | 8.1 | 7.69 | 0.59 | 129 | 0.26 | 3.01 |
| CQ-760-007 | 22 | 11.8 | 3.35 | 27 | 2.95 | 6 | 16 | 25.1 | 0.55 | 3 | 15 | 8.6 | 13.1 | 0.75 | 97 | 0.26 | 2.63 |
| CQ-760-006 | 17 | 13.4 | 0.98 | 18 | 8.24 | 21 | 35 | 13.1 | 0.63 | 16 | 20 | 15.7 | 7.65 | 1 | 120 | 1.57 | 12.9 |
| CQ-760-005 | 15 | 12.8 | 3.37 | 24 | 7 | 13 | 23 | 35.9 | 1.1 | 2 | 4 | 11 | 15.8 | 0.89 | 320 | 0.68 | 7.13 |
| CQ-760-004 | 15 | 20.9 | 3.64 | 37 | 4.57 | 16 | 19 | 44.8 | 0.62 | 7 | 18 | 11 | 13.2 | 0.76 | 75 | 0.73 | 5.86 |
| CQ-760-003 | 10 | 22 | 3.39 | 32 | 4.76 | 9 | 20 | 74.9 | 0.73 | 6 | 9 | 13 | 12.1 | 0.82 | 229 | 0.51 | 4.86 |
| CQ-760-002 | 14 | 30.9 | 3.64 | 35 | 2.43 | 9 | 11 | 95.8 | 0.72 | 8 | 8 | 15 | 8.89 | 0.5 | 333 | 0.36 | 3.38 |
| CQ-760-001 | 19 | 204 | 5.64 | 44 | 3.86 | 21 | 38 | 35.6 | 16.5 | 306 | 26 | 57.8 | 11.3 | 0.51 | 167 | 0.59 | 3.2 |

| SAMPLE | W | U | V | Zn | Ce | Dy | Eu | Ho | La | Lu | Nd | Pr | Sm | Tb | Tm | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CQ-760-041 | 2.5 | 3.63 | 141 | 37.9 | 39.8 | 2.2 | 0.94 | 0.53 | 19.4 | 0.16 | 15.5 | 7.2 | 3.62 | 0.32 | 0.21 | 0.98 |
| CQ-760-040 | 1.2 | 1.95 | 117 | 5.6 | 28.6 | 3.54 | 0.79 | 0.59 | 14.4 | 0.24 | 11.1 | 3.3 | 2.74 | 0.45 | 0.32 | 1.49 |
| CQ-760-039 | 0.21 | 0.78 | 33.6 | 3.6 | 26.3 | 1.78 | 0.47 | 0.21 | 14.5 | 0.13 | 10.1 | 3 | 1.71 | 0.21 | 0.14 | 0.73 |
| CQ-760-038 | 0.18 | 0.79 | 32.4 | 520 | 6.99 | 2.23 | 0.35 | 0.42 | 2.87 | 0.2 | 4.05 | 1.7 | 1.28 | 0.27 | 0.19 | 1.12 |
| CQ-760-037 | 1.1 | 4.51 | 35.4 | 34.3 | 57 | 6.5 | 1.68 | 1.61 | 24.3 | 0.38 | 30.5 | 17 | 8.14 | 0.81 | 0.49 | 2.48 |
| CQ-760-036 | 0.21 | 0.57 | 24 | 4.1 | 18.1 | 3.69 | 0.54 | 0.62 | 11.3 | 0.34 | 8.02 | 2.1 | 1.96 | 0.41 | 0.26 | 1.88 |
| CQ-760-035 | 0.22 | 0.88 | 50.9 | 4.6 | 7.66 | 1.91 | 0.31 | 0.31 | 3.44 | 0.15 | 4.54 | 2 | 1.2 | 0.23 | 0.18 | 0.85 |
| CQ-760-034 | 0.22 | 0.72 | 22.5 | 3.9 | 13.3 | 1.77 | 0.29 | 0.23 | 7.87 | 0.12 | 5.49 | 2.5 | 1.3 | 0.2 | 0.13 | 0.73 |
| CQ-760-033 | 0.29 | 1.03 | 31.4 | 4.4 | 20.6 | 2.41 | 0.39 | 0.31 | 10.9 | 0.18 | 7.78 | 3 | 1.69 | 0.28 | 0.18 | 1.04 |
| CQ-760-032 | 0.23 | 1.13 | 36.3 | 4 | 8.69 | 1.22 | 0.26 | 0.17 | 4.23 | 0.1 | 3.89 | 3.1 | 0.9 | 0.13 | 0.13 | 0.56 |
| CQ-760-031 | 0.19 | 0.52 | 34.4 | 3.9 | 11.8 | 2.4 | 0.45 | 0.31 | 6.05 | 0.15 | 5.54 | 2 | 1.51 | 0.18 | 0.14 | 0.92 |
| CQ-760-030 | 1.5 | 2.22 | 179 | 33 | 36.6 | 6.73 | 1.3 | 1.16 | 18.4 | 0.48 | 16.1 | 10 | 4.27 | 0.71 | 0.45 | 2.73 |
| CQ-760-029 | 0.76 | 1.06 | 43.1 | 4.3 | 13.1 | 3.26 | 0.53 | 0.56 | 5.61 | 0.27 | 6.56 | 2 | 1.82 | 0.35 | 0.25 | 1.5 |
| CQ-760-028 | 0.43 | 1.84 | 69.2 | 4.4 | 32.7 | 5.87 | 0.74 | 0.59 | 16.9 | 0.3 | 14.6 | 3 | 3.24 | 0.41 | 0.35 | 1.79 |
| CQ-760-027 | 0.22 | 0.81 | 34.9 | 4.2 | 16.4 | 3.54 | 0.54 | 0.4 | 7.89 | 0.21 | 8.23 | 2.6 | 2.08 | 0.25 | 0.19 | 1.22 |
| CQ-760-026 | 0.29 | 0.68 | 40.5 | 3.8 | 9.27 | 2.02 | 0.37 | 0.33 | 4.79 | 0.15 | 5.07 | 1.8 | 1.28 | 0.25 | 0.18 | 0.89 |
| CQ-760-025 | 0.29 | 0.7 | 43.3 | 400 | 8.37 | 1.44 | 0.27 | 0.23 | 3.67 | 0.11 | 4.07 | 1.6 | 1 | 0.17 | 0.14 | 0.66 |
| CQ-760-024 | 0.15 | 0.59 | 39.9 | 3.6 | 12.1 | 1.27 | 0.26 | 0.19 | 7.89 | 0.1 | 3.97 | 1.6 | 0.93 | 0.14 | 0.12 | 0.62 |
| CQ-760-023 | 0.11 | 0.59 | 14 | 2.7 | 9.84 | 1.15 | 0.23 | 0.19 | 5 | 0.08 | 4.17 | 1.2 | 0.95 | 0.16 | 0.08 | 0.55 |
| CQ-760-022 | 0.56 | 1.08 | 58 | 4.7 | 19.6 | 3.28 | 0.64 | 0.53 | 9.79 | 0.23 | 9.78 | 1.9 | 2.36 | 0.41 | 0.25 | 1.34 |
| CQ-760-021 | 0.47 | 0.82 | 39.8 | 3.9 | 21.6 | 1.69 | 0.38 | 0.3 | 13.7 | 0.12 | 6.99 | 2.3 | 1.47 | 0.2 | 0.15 | 0.75 |
| CQ-760-020 | 0.52 | 1.01 | 43.9 | 980 | 14.4 | 1.93 | 0.42 | 0.29 | 6.62 | 0.14 | 6.07 | 1.6 | 1.56 | 0.26 | 0.15 | 0.84 |
| CQ-760-019 | 2.5 | 2.14 | 119 | 70.4 | 24.3 | 2.23 | 0.65 | 0.37 | 13.3 | 0.18 | 10.3 | 7.4 | 2.47 | 0.29 | 0.21 | 0.95 |
| CQ-760-018 | 1.03 | 1.51 | 252 | 7.4 | 16.5 | 4.71 | 0.82 | 0.76 | 6.56 | 0.36 | 9.17 | 1.7 | 2.87 | 0.53 | 0.43 | 2.1 |
| CQ-760-017 | 0.53 | 0.37 | 42.3 | 25.7 | 12.9 | 2.93 | 0.54 | 0.47 | 6.62 | 0.21 | 6.23 | 1.4 | 1.81 | 0.42 | 0.26 | 1.25 |
| CQ-760-016 | 0.14 | 0.49 | 25.2 | 11 | 9.14 | 1.97 | 0.35 | 0.32 | 5.48 | 0.15 | 4.4 | 1.1 | 1.26 | 0.24 | 0.16 | 0.94 |
| CQ-760-015 | 0.37 | 1.03 | 30.8 | 4 | 11.8 | 1.95 | 0.31 | 0.36 | 5.51 | 0.18 | 6.25 | 1.5 | 1.45 | 0.24 | 0.19 | 1.03 |
| CQ-760-014 | 0.44 | 1.35 | 23 | 3.4 | 13.6 | 2.78 | 0.39 | 0.49 | 6.31 | 0.25 | 6.84 | 1.3 | 1.72 | 0.23 | 0.24 | 1.48 |
| CQ-760-013 | 1 | 5.41 | 26.4 | 3.4 | 53.8 | 3.34 | 0.76 | 0.99 | 24.8 | 0.25 | 23 | 6.5 | 4.32 | 0.41 | 0.29 | 1.57 |
| CQ-760-012 | 0.67 | 2.14 | 64.5 | 5.4 | 36.3 | 4.85 | 0.92 | 0.74 | 15.4 | 0.35 | 15.5 | 2.3 | 4.01 | 0.59 | 0.34 | 2.1 |
| CQ-760-011 | 0.76 | 1.62 | 93.7 | 19 | 24.9 | 3.15 | 0.73 | 0.42 | 13.3 | 0.23 | 11.5 | 13 | 2.65 | 0.37 | 0.24 | 1.39 |
| CQ-760-010 | 0.4 | 0.81 | 71.4 | 4.9 | 9.8 | 1.49 | 0.34 | 0.28 | 4.93 | 0.12 | 4.86 | 2 | 1.19 | 0.17 | 0.13 | 0.66 |
| CQ-760-009 | 0.42 | 0.61 | 38.3 | 3.6 | 6.43 | 0.83 | 0.19 | 0.14 | 3.67 | 0.08 | 3.08 | 1.4 | 0.7 | 0.09 | 0.1 | 0.42 |
| CQ-760-008 | 0.82 | 1.72 | 41.3 | 4.2 | 15.1 | 1.91 | 0.4 | 0.34 | 7.78 | 0.18 | 6.71 | 1.6 | 1.58 | 0.22 | 0.18 | 1.01 |
| CQ-760-007 | 0.93 | 1.69 | 65.5 | 5.1 | 24.8 | 4.02 | 0.74 | 0.8 | 11.5 | 0.43 | 12.2 | 3.6 | 3.21 | 0.48 | 0.43 | 2.41 |
| CQ-760-006 | 0.65 | 4.31 | 18 | 3.9 | 45.5 | 3.4 | 0.59 | 0.95 | 20.7 | 0.21 | 20.3 | 5.7 | 3.81 | 0.42 | 0.28 | 1.33 |
| CQ-760-005 | 1.4 | 3.73 | 38.5 | 5.9 | 49 | 5.73 | 1.15 | 1.31 | 33.8 | 0.54 | 19.2 | 5.9 | 5.38 | 0.81 | 0.53 | 3.24 |
| CQ-760-004 | 2 | 2.94 | 43 | 5.7 | 20.1 | 6.02 | 0.88 | 1.23 | 8.55 | 0.61 | 12.3 | 1.8 | 3.62 | 0.76 | 0.61 | 3.43 |
| CQ-760-003 | 1.23 | 2.59 | 49.4 | 5.3 | 37.4 | 5.24 | 0.92 | 0.94 | 17.7 | 0.46 | 17.5 | 3.4 | 4.1 | 0.66 | 0.46 | 2.66 |
| CQ-760-002 | 1.97 | 3.26 | 51.3 | 5.3 | 21.4 | 5.42 | 0.86 | 0.96 | 10.4 | 0.46 | 11.6 | 3 | 3.44 | 0.56 | 0.49 | 2.7 |
| CQ-760-001 | 3.21 | 2.31 | 102 | 15 | 19.5 | 1.48 | 0.52 | 0.19 | 10.8 | 0.16 | 8.13 | 6.5 | 1.98 | 0.22 | 0.18 | 0.92 |

**ARCHER, CATHRO**
& ASSOCIATES LIMITED
ONSULTING GEOLOGICAL ENGINEERS

VANCOUVER, B.C. (604) 688-2568 BOX 4127, WHITEHORSE, Y.T. Y1A 3S9 (403) 667-4415

1016 - 510 WEST HASTINGS STREET
VANCOUVER, B.C. V6B 1L8

# AFFIDAVIT

I, Joan Mariacher, of Vancouver, B.C. make oath and say:

That to the best of my knowledge the attached Statement of Expenditures for exploration work on the Y434 and Y435 Coal Exploration Licences on Claim Sheet 115H/8 is accurate.

Joan Mariacher

Sworn before me at Vancouver, B.C.

this 15th day of

April, 1992

Notary, Yukon Territory

Statement of Expenditures
CEL Y434 and Y435
April 14, 1992

Expenses incurred June, 1991 to April, 1992 - field and office

Supervision and Labour

| | | |
|---|---|---|
| A. Archer (geologist, P. Eng.) - 36 hours at $55/hr | $ 1,980.00 | |
| R. Carne (geologist) - 153 hours at $42/hr | 6,426.00 | |
| M.P. Phillips (geologist) - 30 hours at $37.50/hr | 1,125.00 | |
| J. Mariacher - 12 3/4 hours Whse. at $37/hr | 471.75 | |
| - 15 1/2 hours Van. at $32/hr | 496.00 | |
| M. Cooke (secretarial) - 13 1/4 hours at $27/hr | 357.75 | |
| - 16 1/4 hours at $28/hr | 455.00 | $11,311.50 |

Expenses

| | | |
|---|---|---|
| E. Caron Diamond Drilling | 4,331.00 | |
| Printing, drafting, telephone, office etc. | 2,618.61 | |
| Room and board | 1,326.96 | |
| Freight | 83.90 | |
| Truck rental and gas | 395.76 | 8,756.23 |
| | | $20,067.73 |

# SHEET 115H-8

LATITUDE 61° 15' To 61°30'
LONGITUDE 136°00' To 136°30'

MAP# 115H/8 (428)

DWG 71

093032

**CANADA**
DEPARTMENT OF NORTHERN AFFAIRS AND NATIONAL RESOURCES

SCALE: ½ MILE To 1 INCH

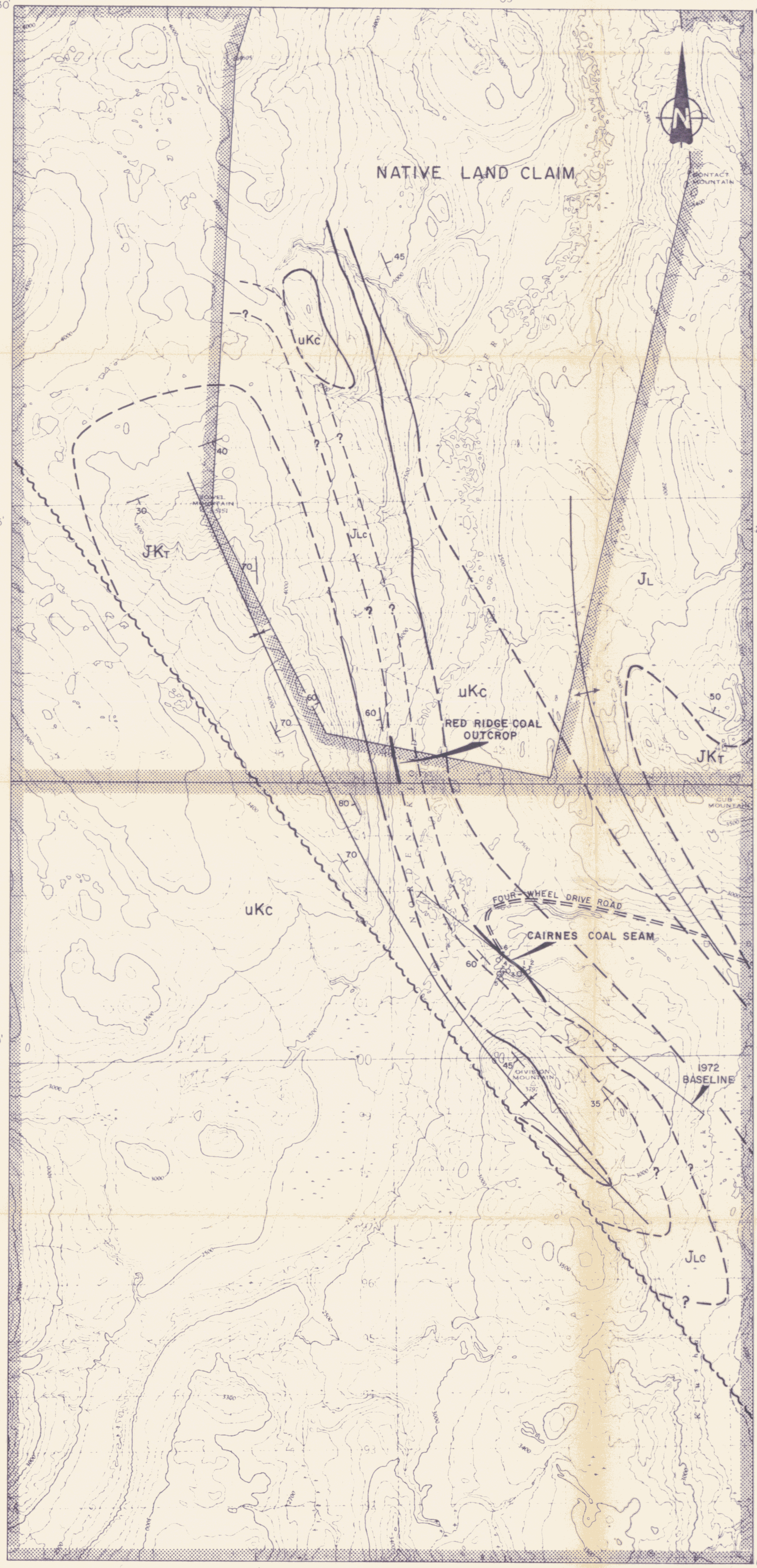
FT. 1500 0 1500 3000 4500 6000 7500 9000 10500 FT.

ISSUED UNDER THE AUTHORITY OF THE MINISTER

Note: Entry on certain lands is withdrawn from staking in cross-hatched areas to facilitate the settlement of Native Land Claims without prejudice to Existing Surface and Subsurface Rights.

| | | |
|---|---|---|
| 115H-10 | 115H-9 | 105E-12 |
| 115H-7 | 115H-8 | 105E-5 |
| 115H-2 | 115H-1 | 105E-4 |


115H-8





LOCATION MAP

## SYMBOLS

| | |
|---|---|
| 35 | attitude of sedimentary rocks |
| | geological contact (known, assumed) |
| | fault |
| | syncline |
| | anticline |
| | limits of coal exploration licence |

## LITHOLOGIES

**UPPER CRETACEOUS**

| | |
|---|---|
| uKc | CARMACKS GP<br>andesite flows |

**UPPER JURASSIC AND/OR CRETACEOUS**

| | |
|---|---|
| JKT | TANTALUS FM<br>conglomerate, sandstone |

**LOWER AND MIDDLE JURASSIC**

LABERGE GP

| | |
|---|---|
| JL | shale, greywacke, sandstone |
| JLC | coal measures |

Figure 2

ARCHER, CATHRO & ASSOCIATES (1981) LIMITED

# REGIONAL GEOLOGY

## DIVISION MOUNTAIN COAL

W4 JOINT VENTURE

SCALE 1:50,000

Miles 1 1/2 0 1 2 3 Miles

Kilometres 1 1/2 0 1 2 3 4 Kilometres

093032

DWG 70 MAP# 115 H/8 427



LOCATION MAP

## SYMBOLS

- attitude of sedimentary rocks
- geological contact (known, assumed)
- fault
- syncline
- bulldozer or excavator trench
- diamond drill hole
- existing cut line
- proposed cut line

## LITHOLOGIES

**UPPER CRETACEOUS**

uKc — CARMACKS GP — andesite flows

**UPPER JURASSIC AND/OR CRETACEOUS**

JKT — TANTALUS FM — conglomerate, sandstone

**LOWER AND MIDDLE JURASSIC**

JL — LABERGE GP — shale, greywacke, sandstone

JLc — coal-bearing stratigraphy

frequent coal seams

Cairnes Seam

Figure 3

ARCHER, CATHRO & ASSOCIATES (1981) LIMITED

# GEOLOGY
## TESLIN CREEK AREA
### DIVISION MOUNTAIN COAL
### W4 JOINT VENTURE

093032

SCALE 1:10,000

0 100 200 300 400 500 1000 Metres

0 500 1000 2000 3000 Feet

429

DWG 72 MAP# 115 H/8