L-SHELL NORTH CENTRAL
BLOCK - 78(1)A

GEOLOGICAL
REPORT

-1978-

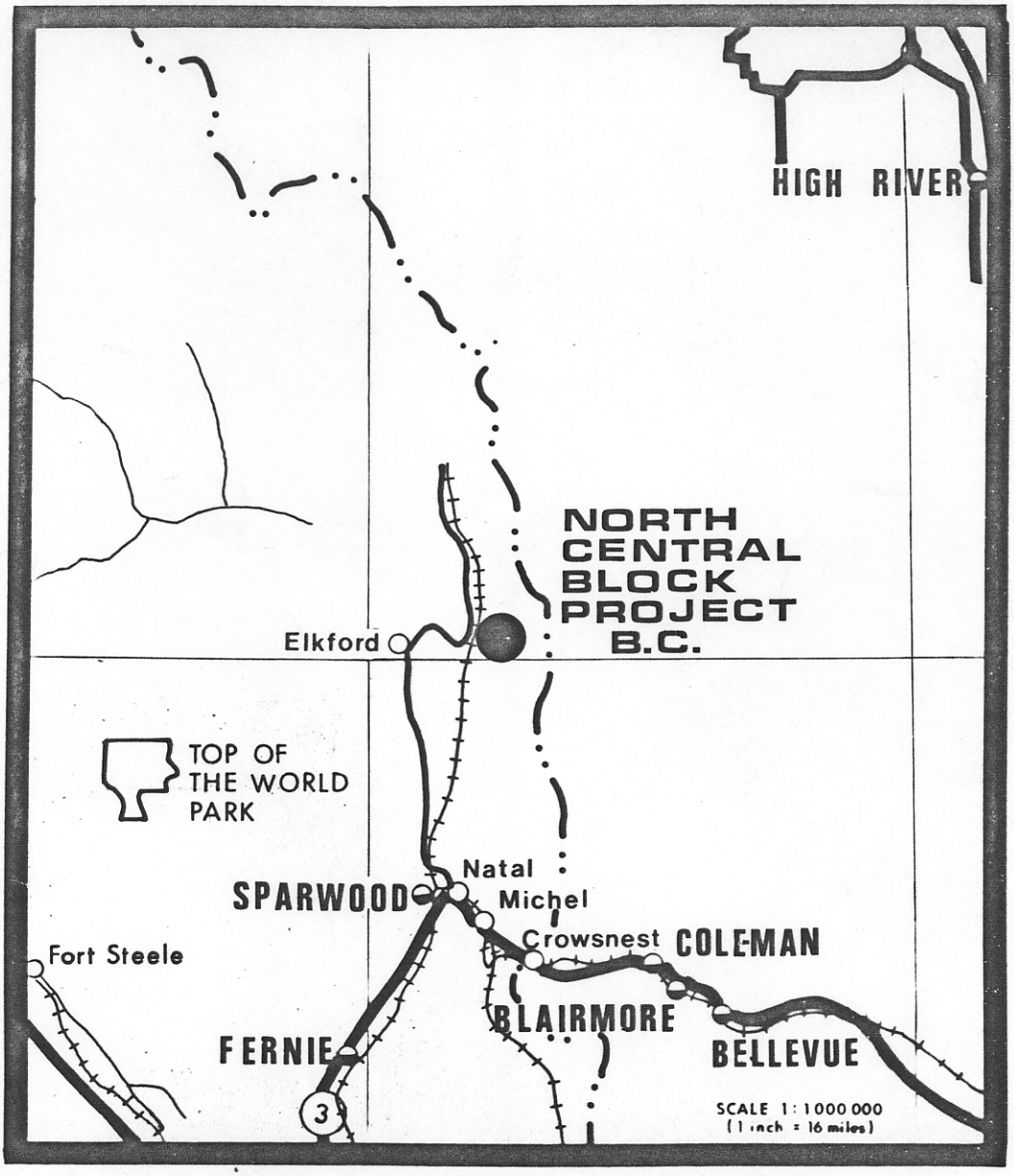
439

K-SHELL-NORTH CENTRAL BLOCK 77(1)A

# CROWS NEST RESOURCES LIMITED
## SHELL CANADA RESOURCES LIMITED

Report on Coal Licences
277 to 293 Inclusive
304 & 1299, 1300, 1301, 1302

OPEN FILE




RECEIVED FOR [illegible]
GEOLOGICAL BRANCH
ASSESSMENT REPORT

# NORTH CENTRAL BLOCK PROJECT

## KOOTENAY DISTRICT B.C.

00 439

# GEOLOGICAL REPORT

WORK DONE FROM MAY 29, 1978 TO AUGUST 23, 1978

NORTH CENTRAL BLOCK PROJECT

KOOTENAY LAND DISTRICT, B.C.

B.C. COAL LICENCES

NOS. 277 TO 293 INCLUSIVE

304 & 1299, 1300, 1301, 1302

HELD BY SHELL CANADA RESOURCES LIMITED

OPERATED BY CROWS NEST RESORUCES LIMITED

NTS 82G/15, 82J/2

LAT. $50^{o}$ 00' N, LONG. $114^{o}$ 45' W

BY
JOHN FISHER & GARTH SLOAN
1979-04-30

PROFESSIONAL VERIFICATION OF REPORT

Entitled: North Central Block Project
Kootenay Land District, B.C., 1978
B.C. Coal Licenses
Nos. 277 to 293 Inclusive
304 & 1299, 1300, 1301, 1302

Mr. A. John Fisher planned and carried out the 1978 geological field program on North Central Block B.C. Coal Licenses held by Shell Canada Resources Ltd. and operated by Crows Nest Resources Ltd. He also prepared this report. Mr. Frank Martonhegyi supervised the activity of this program under the general direction of the undersigned.

John Fisher, B.Sc., graduated in Geology from the University of Calgary in 1974. His experience in Western Canadian coal exploration since 1974 includes positions with:

- Spence Taylor & Associates Ltd., Calgary, Alberta
- Shell Canada Resources Ltd., Calgary, Alberta
- Crows Nest Resources Ltd., Calgary, Alberta

Frank Martonhegyi, M.E., graduated in Mining Geological Engineering from the University of the Heavy Industry, Hungary,in 1962; and received post-graduate training at the University of Saskatchewan, Saskatoon, in 1969-1971. His experience in Western Canadian coal exploration since 1971 includes positions with:

- CanPac Minerals Ltd., Calgary, Alberta
- Shell Canada Resources Ltd., Calgary, Alberta
- Crows Nest Resources Ltd., Calgary, Alberta

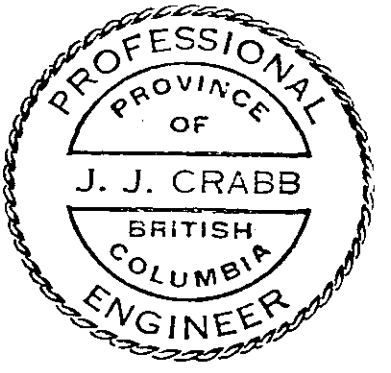
His prior work experience includes underground coal mining geology, geotechnical engineering and geochemistry in Hungary, Austria and Canada.

He currently holds the position of Staff Geologist for Crows Nest Resources Ltd.,supervising coal exploration in British Columbia.

I consider both the aforementioned geologists to be well qualified to undertake the responsibilities they were assigned on this project. I am satisfied that the attached report dated April 30, 1979 has been competently prepared and justly represents the information obtained from this project.

J. J. Crabb, P. Eng.

April 30, 1979



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Ewin Pass Type Section

| | |
|---|---|
| MR-4(A) | MB-1 |
| MR-4(B) | YH-1 |
| MR-5(A) | MR-9 |
| | MR-11 |
| MG-6 | |
| MR-7 | ER-8(A) |
| MG-7(B) | |
| MG-7(A) | |
| | ER-14 |
| MG-7(C) | ER-17-16 |
| MR-8 | |

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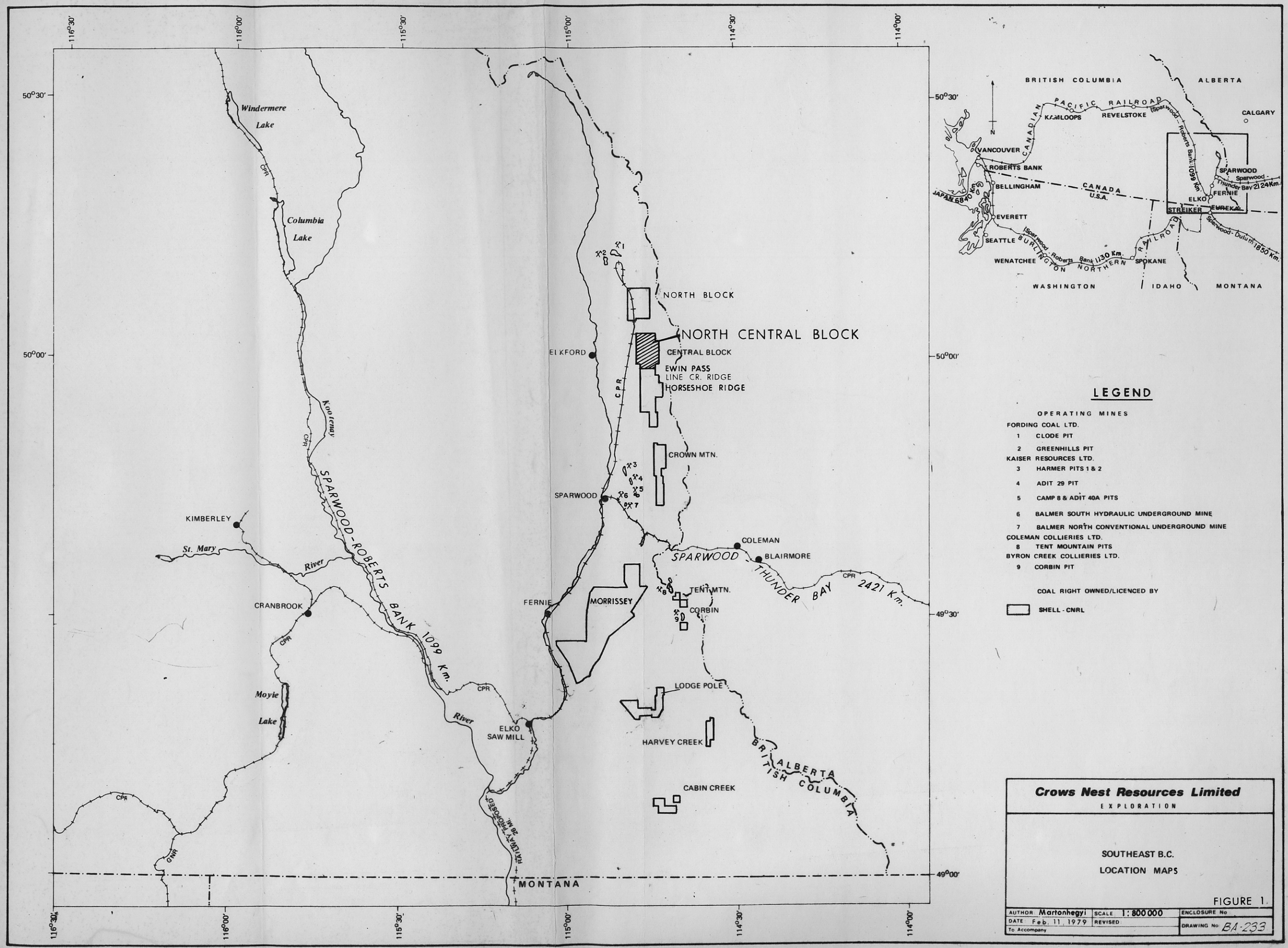



## LEGEND

OPERATING MINES

FORDING COAL LTD.
1 CLODE PIT
2 GREENHILLS PIT

KAISER RESOURCES LTD.
3 HARMER PITS 1 & 2
4 ADIT 29 PIT
5 CAMP 8 & ADIT 40A PITS
6 BALMER SOUTH HYDRAULIC UNDERGROUND MINE
7 BALMER NORTH CONVENTIONAL UNDERGROUND MINE

COLEMAN COLLIERIES LTD.
8 TENT MOUNTAIN PITS

BYRON CREEK COLLIERIES LTD.
9 CORBIN PIT

COAL RIGHT OWNED/LICENCED BY

SHELL - CNRL

**Crows Nest Resources Limited**
EXPLORATION

SOUTHEAST B.C.
LOCATION MAPS

FIGURE 1.

| | | |
|---|---|---|
| AUTHOR Martonhegyi | SCALE 1:800000 | ENCLOSURE No |
| DATE Feb. 11, 1979 | REVISED | DRAWING No BA-233 |
| To Accompany | | |

## 1.0 SUMMARY

The Central Block of British Columbia Coal Licences is located approximately 1150 kilometres east of Vancouver in the Crowsnest Pass area.

Twenty-two licences in this block are held by Shell Canada Resources Limited and cover 4 315 hectares. The property is 27 km north of Sparwood, B.C., by road and 13 km east of Elkford. The northern boundary of the licenced area is 4 km east of C.P.R.'s Sparwood/Fording rail line.

This report deals with the northern half of the Central Block, (approximately 50°N, 114° 45' W), which has been designated the "NORTH CENTRAL BLOCK".

In 1978 a coal exploration project was carried out in the area by Crows Nest Resources Ltd., a wholly owned subsidiary of Shell Canada Resources Limited.

The project consisted of;

- o Geodetic survey
- o Geological mapping
- o Stratigraphic survey
- o Hand trenching

An area of about 17 $km^2$ was mapped to 1:5 000 scale, twenty-three

stratigraphic sections were measured for a total of 3,800 m and fourteen trenches were dug by hand.

The geodetic survey consisted of aerial photographing of the entire area at a scale of 1:40 000 and of the eastern portion at a scale of 1:20 000. Photogrammetric maps, of scales 1:5 000 and 1:2 000 with 5.0 and 2.0 m contours respectively, were subsequently constructed.

The project lasted 2.5 months in the field and cost $90,653.00. The cost including the preparation of this report. It is divided between new Groups A and B (preliminary designation).

Previous exploration in this sector, conducted by Crows Nest Industries Ltd., was primarily directed to the Ewin Pass area. It delineated 23 million metric tonnes of raw, surface mineable, coal there. The coal is of medium volatile bituminous rank, low in sulphur and exhibits good coking characteristics with F.S.I. values of 5 to 8. The coal is in a dip-slope attitude favourable to open pit mining.

Geological mapping in 1978 was successful in identifying other areas of potential as follows.

In the southeastern portion of the block a stratigraphic section, thickened by faulting, contains 61 m of coal. This coal section extends for more than a kilometre along strike.

In the southwestern portion of the Block a 6 m thick seam is present in a dip-slope attitude. It extends for more than a kilometre along strike. There are at least three other mineable seams above this seam.

In the northeastern segment of the North Central Block area a synclinal structure has been defined which may contain at least the lower four seams of the Kootenay Formation. Further exploration of this area should be assigned a high priority. Substantial reserves in a very good attitude and location for an open pit operation can be expected.

In the northwestern portion of the block it is expected that further reserves will be found. These will be south of the old Imperial Coal and Coke Company's adits where five of the eight sampled seams were found to be of coking quality.

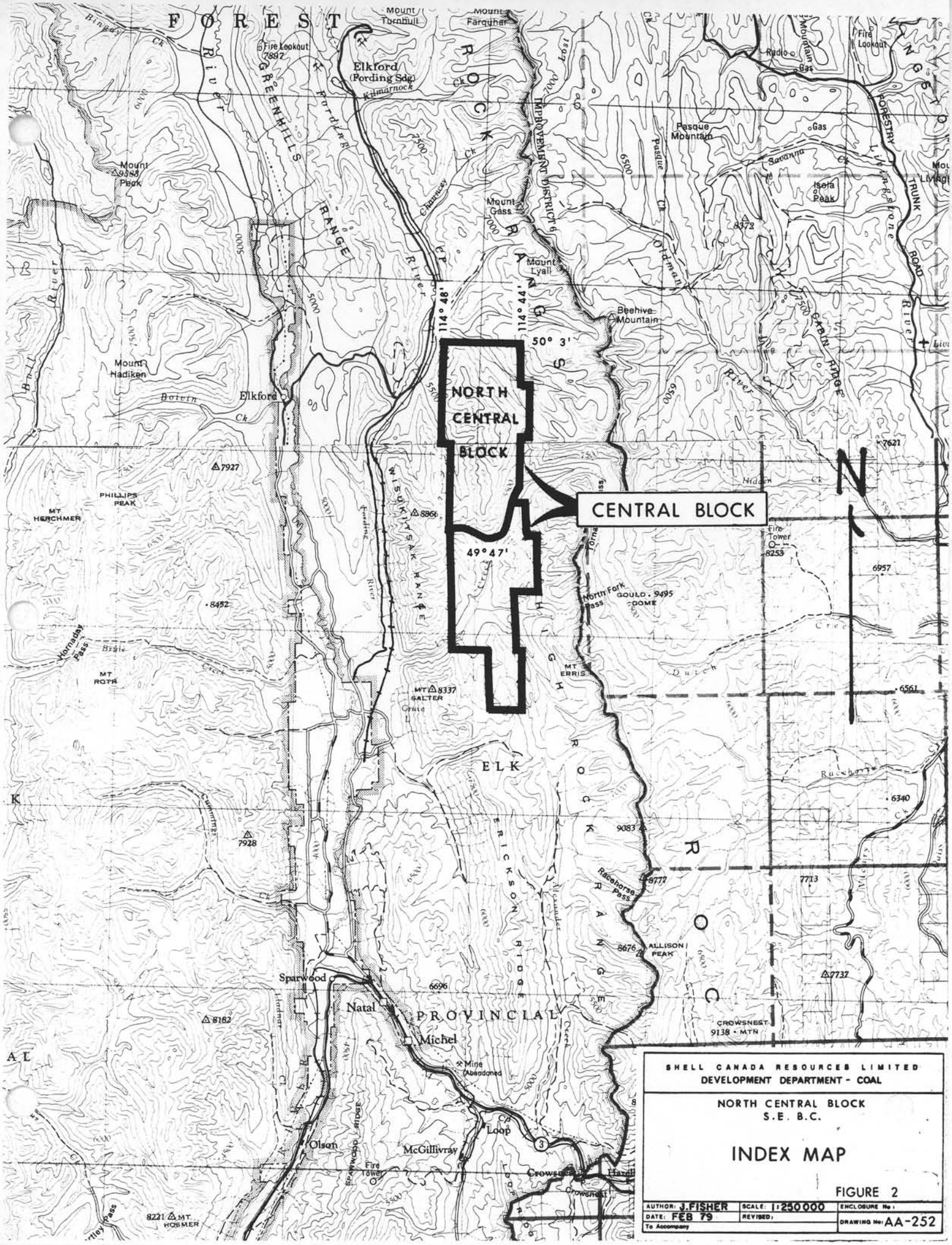
It is recommended that;

a) Four adits be driven into the coal seams in the Ewin Pass area to determine the quality of the coal present.

b) The Ewin Pass area be mapped in detail at a scale of 1:2 000.

c) The synclinal structure in the northeastern sector be mapped and potential coal seam horizons trenched. If the results are encouraging, helicopter - supported drilling of at least one deep hole be executed.

d) Mapping at a scale of 1:5 000 be continued and the areas of higher potential be mapped at 1:2 000 scale.




SHELL CANADA RESOURCES LIMITED
DEVELOPMENT DEPARTMENT - COAL

NORTH CENTRAL BLOCK
S.E. B.C.

# INDEX MAP

FIGURE 2

| | | |
|---|---|---|
| AUTHOR: J.FISHER | SCALE: 1:250 000 | ENCLOSURE No: |
| DATE: FEB 79 | REVISED: | DRAWING No: AA-252 |
| To Accompany | | |

## 2.0 CONCLUSIONS AND RECOMMENDATIONS

It has been shown that large reserves of coal are present in virturally all sectors of the North Central Block. However it is almost without doubt that the Ewin Pass block will be the next area to be considered for a mine site.

In view of this it is strongly recommended that 4 adits be driven into seams 6, 7, 8 and 9 to better determine the quality of the coal present. It is also recommended that detailed mapping on a scale 1:2 000/2.0 m be done in this block.

This will require that the CNI road be repaired to allow field crews access to this area. On the whole this road is in remarkably good condition over approximately 90+% of its length. The areas that require repair are those which have been washed out by runoff, and one slump area.

In the northeastern sector of the block the synclinal structure merits close examination. This should take the form of detailed (1:2 000 scale), field mapping and hand trenching. If the results of this exploration are encouraging a core hole should be drilled there using a helicopter transportable drill rig.

The attitude of the structure here, dip-slope, and the proximity of the Ewin Creek road, (approximately 200 m distant), combined with the proximity of the CPR's Sparwood/Fording line, (4000 m), make this an extremely attractive situation.

## 3.0 OBJECTIVES

The objectives of the 1978 field season were to;

a) Construct lithological and structural sections.

b) Delineate target areas for future work.

c) Measure and map coal seams which were not previously mapped.

d) Prepare a geological report on the area which will enable us to concentrate future work on specific target areas.

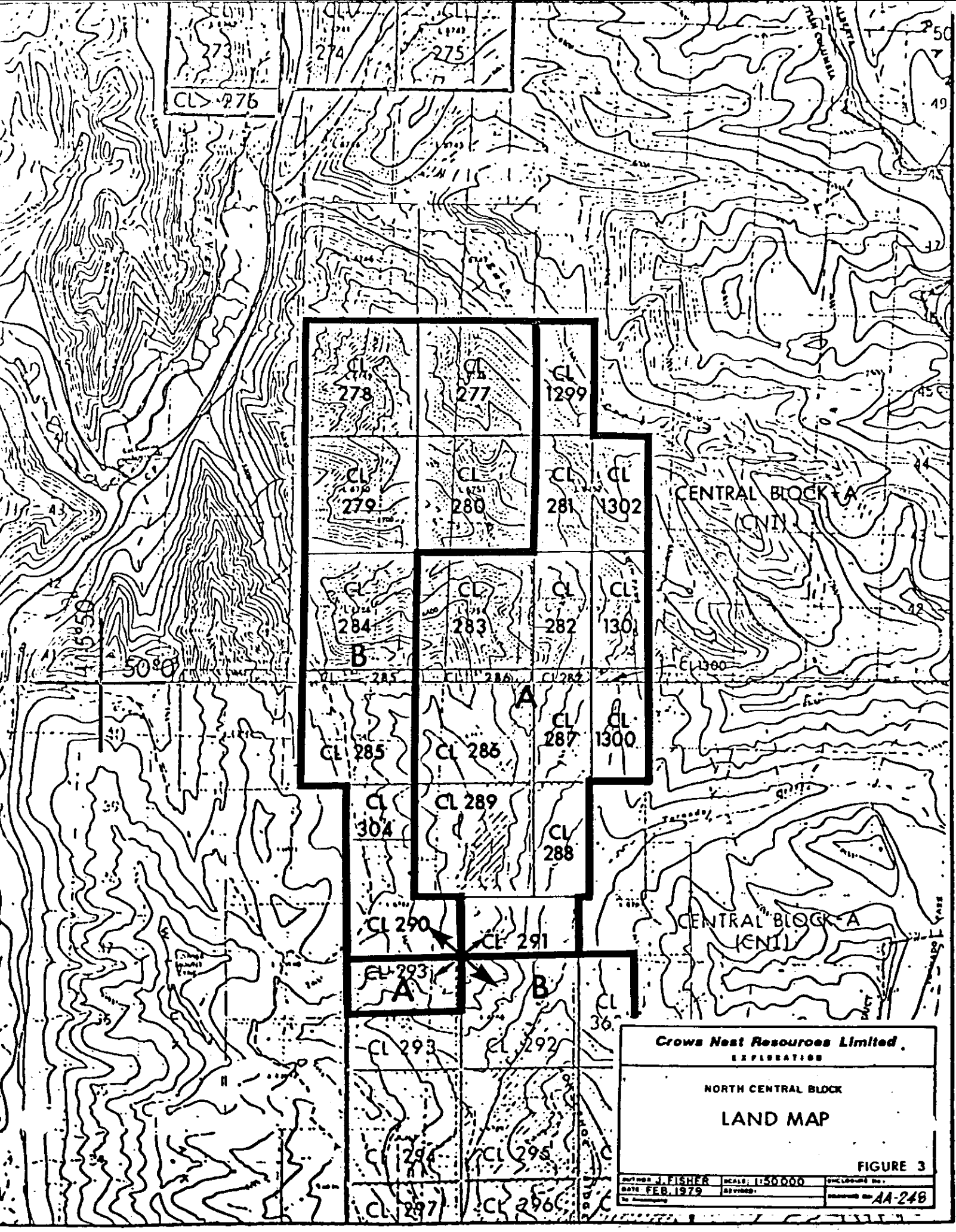
# 4.0 LOCATION

## 4.1 Geographic Location

The property is located adjacent to the Elk River Valley in the CROWSNEST PASS area of the Rocky Mountains in southeastern British Columbia. It is approximately 1150 kilometres east of Vancouver and 27 kilometres north of the town of Sparwood.

The North Central Block is to be found on National Topographic System (NTS) map 82G, FERNIE (1:250 000), 82G/15, TORNADO MOUNTAIN (1:50 000), and 82J/2 FORDING RIVER (1:50 000). It is encompassed by $49^{o}$ 57' N, $50^{o}$ 03' N, and $114^{o}$ 44' W, $114^{o}$ 48' W of the prime meridian, (See figure No. 2), and comprises slightly more than 43 $km^{2}$.

The project area is adjacent to, and north of, our Line Creek project area.


CL 273
CL 274
CL 275
CL 276
CL 278
CL 277
CL 1299
CL 279
CL 280
CL 281
CL 1302
CENTRAL BLOCK A
(CN1)
CL 284
CL 283
CL 282
CL 130
B
A
CL 285
CL 286
CL 287
CL 1300
CL 304
CL 289
CL 288
CL 290
CL 291
CL 293
A
B
CL 293
CL 292
CL 294
CL 295
CL 297
CL 296
CENTRAL BLOCK A
(CN1)
Crows Nest Resources Limited
EXPLORATION
NORTH CENTRAL BLOCK
LAND MAP
FIGURE 3
DRAWN J. FISHER
SCALE 1:50000
DATE FEB. 1979
AA-248

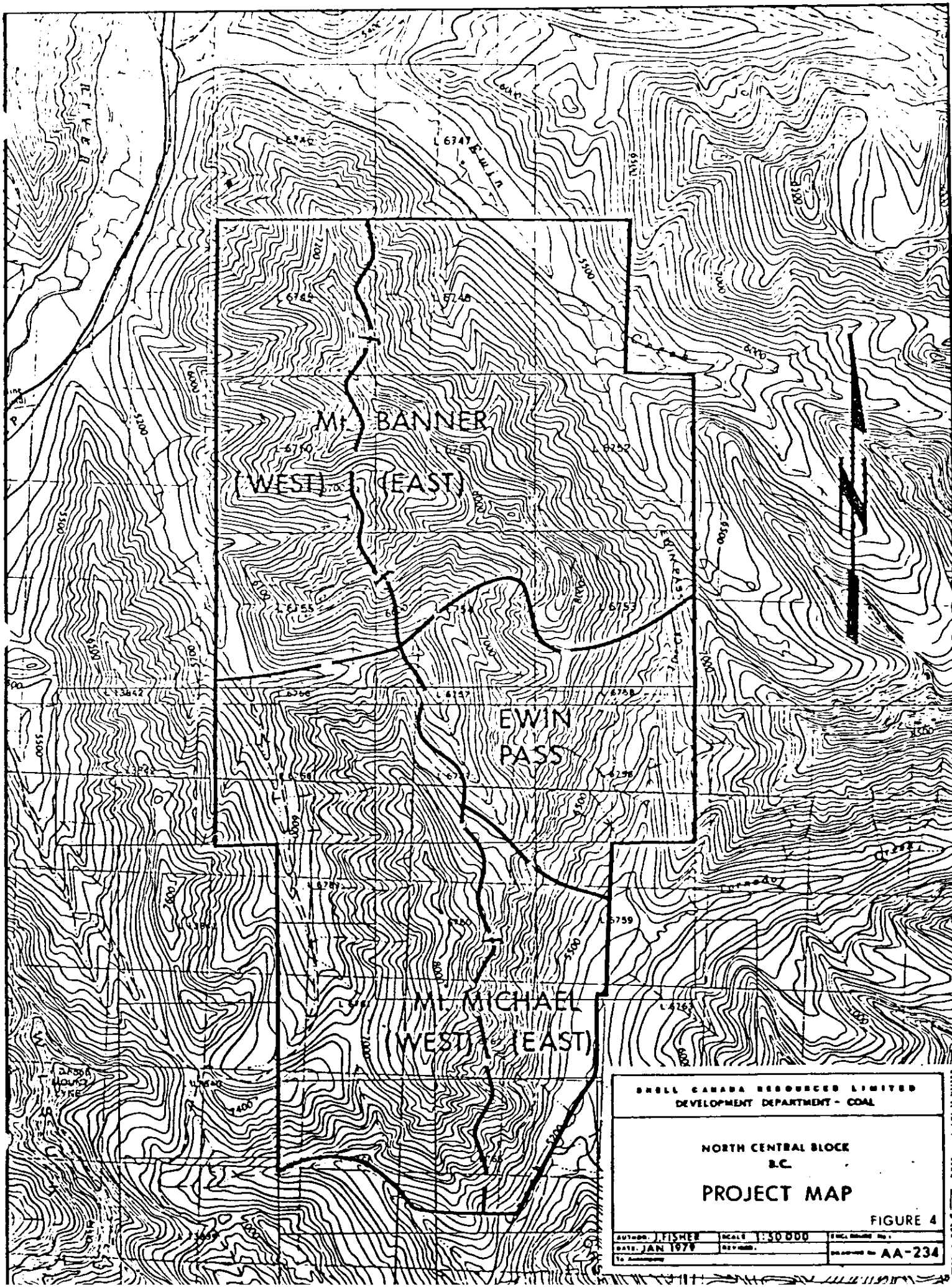
## 4.2 Licence Tenure

SHELL CANADA RESOURCES LIMITED (SCRL), holds the following groups of British Columbia Coal Licences: (See Figure No. 3)

| Group A | | Group B | |
|---|---|---|---|
| NO. | HA | NO. | HA |
| 281 | 130 | 277 | 259 |
| 282 | 130 | 278 | 259 |
| 283 | 259 | 279 | 259 |
| 286 | 259 | 280 | 259 |
| 287 | 130 | 284 | 259 |
| 288 | 130 | 285 | 259 |
| 289 | 259 | 304 | 82 |
| 291 | 133 | 290 | 211 |
| 293 | 259 | 292 | 259 |
| 1299 | 130 | | |
| 1300 | 130 | | |
| 1301 | 130 | | |
| 1302 | 130 | | |
| | 2209 Ha | | 2106 Ha |

This gives a total of 43.15 $km^2$ for the North Central Block.

Work done on the above licences previously and during the 1978 field season was sufficient to obtain work credit to cover a ten year period.




SHELL CANADA RESOURCES LIMITED
DEVELOPMENT DEPARTMENT - COAL

NORTH CENTRAL BLOCK
B.C.

# PROJECT MAP

FIGURE 4

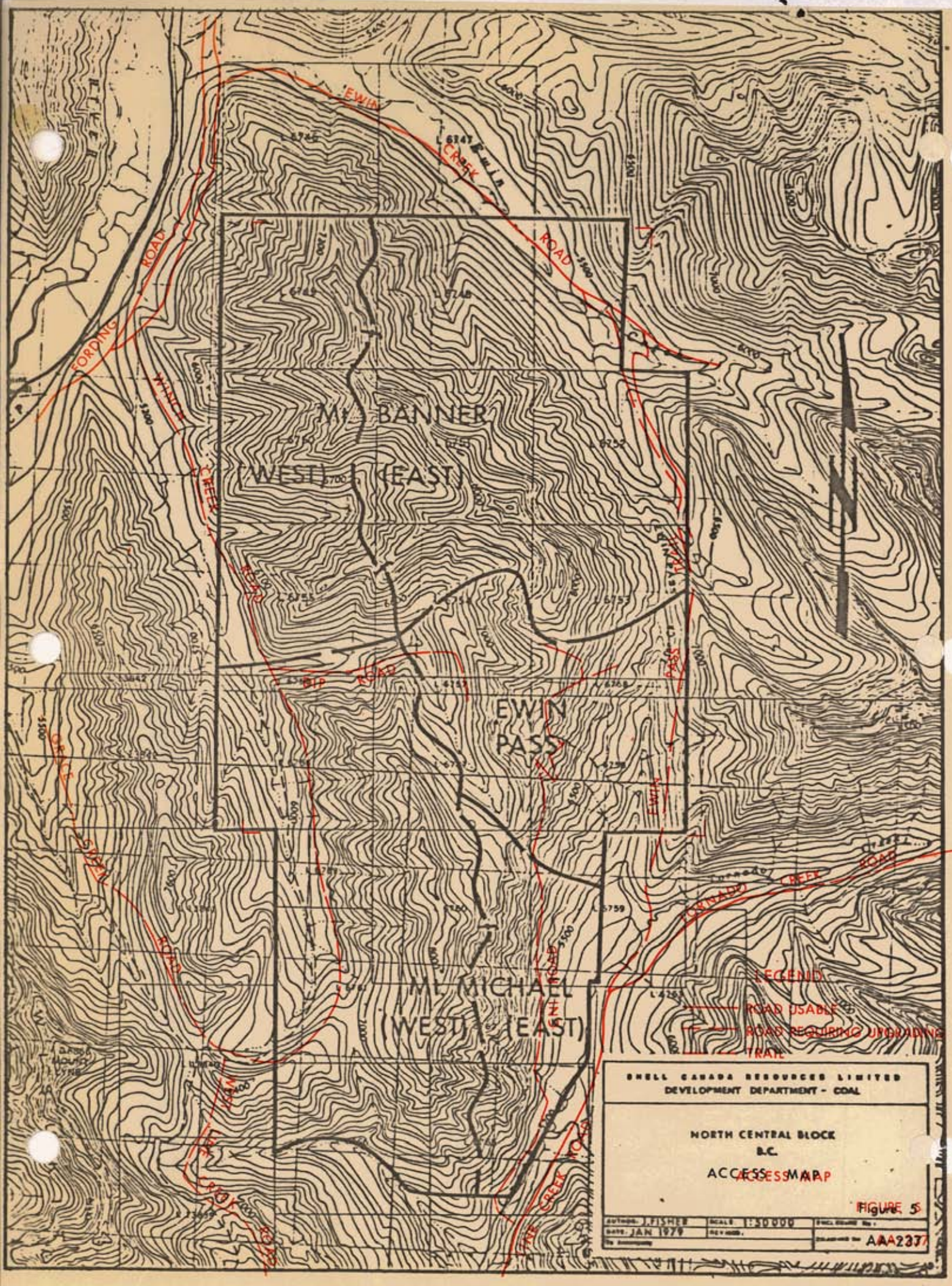
| | | |
|---|---|---|
| AUTHOR J. FISHER | SCALE 1:50 000 | DRAWING No. AA-234 |
| DATE JAN 1979 | REVISED | |

## 4.3 Project Area Subdivisions

Because of the magnitude of the area involved it was found necessary to subdivide the area into more discrete units. This was done by dividing the area along structural and erosional boundaries (Figure No. 4).

The major division was along the trace of the Fording Thrust fault which has a generally north/south trend and was utilized to divide the area into east and west areas.

The Ewin Pass block is an eroded area which separates the higher areas flanking it to the north and south. In the southern portion the area has been divided and designated Mount Michael (East) and Mount Michael (West). To the north of the Ewin Pass block the area has been divided and designated as Mount Banner (East) and Mount Banner (West).


EWIN CREEK ROAD
FORDING ROAD
WINCH CREEK ROAD
Mt. BANNER
(WEST) (EAST)
EWIN PASS
Mt. MICHAEL
(WEST) (EAST)
FORNADO CREEK ROAD
LEGEND
ROAD USABLE
ROAD REQUIRING UPGRADING
TRAIL
SHELL CANADA RESOURCES LIMITED
DEVELOPMENT DEPARTMENT - COAL
NORTH CENTRAL BLOCK
B.C.
ACCESS MAP
ACCESS MAP
Figure 5
AUTHOR: J. FISHER
SCALE 1:50000
DATE: JAN 1979
REVISED:
AA237

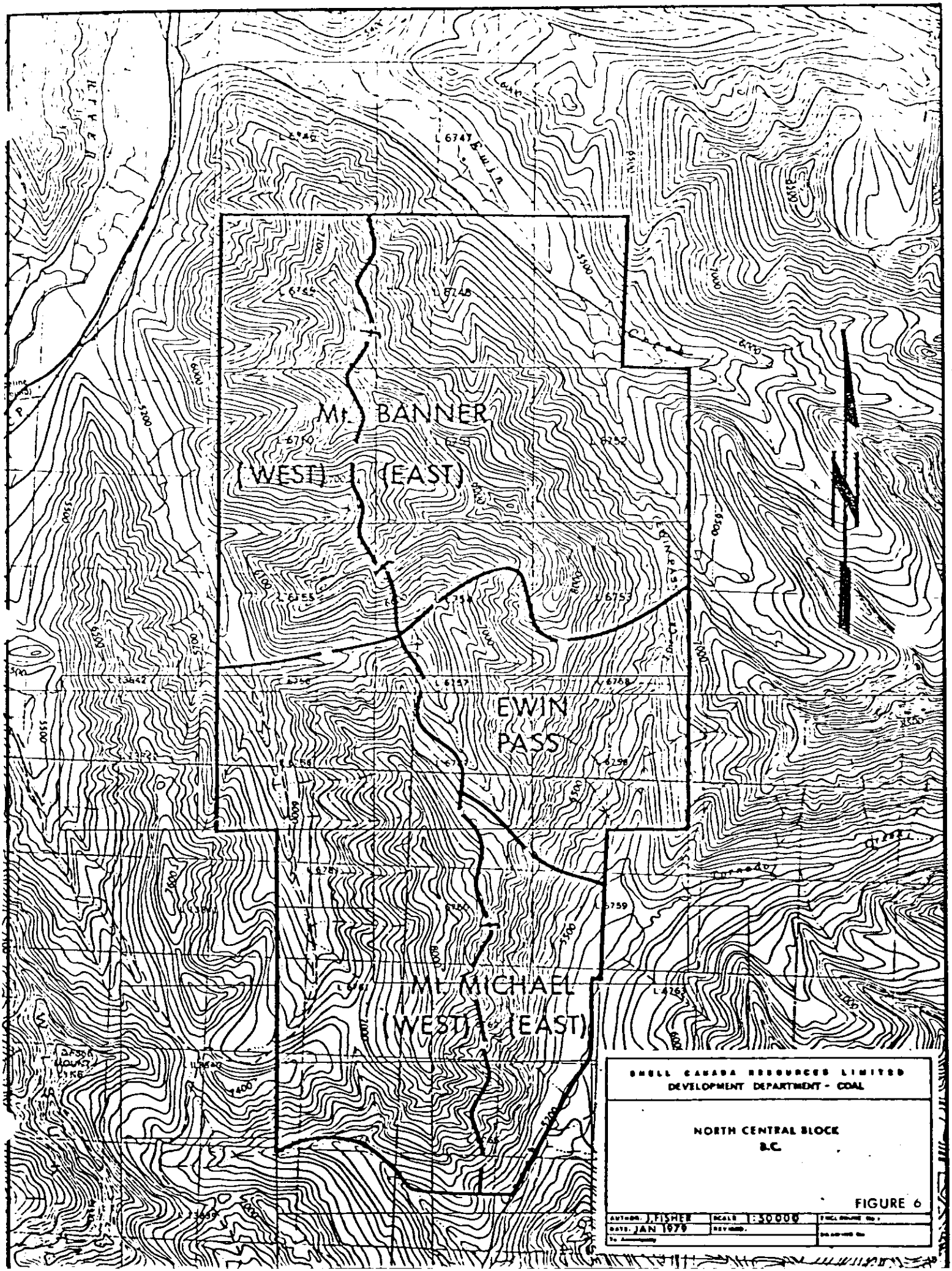
## 4.4 Access

The southern portion of the area is accessible from the south via the Line Creek road. (See Figure No. 5) This road follows the valley floor, paralleling the North Central Block for approximately 2.7 km. It is necessary to climb the slopes from the road to the work area.

Crows Nest Industries Limited constructed a road, "CNI Road", from the valley floor to Ewin Pass Ridge in the late'60s. The road has not been maintained and is not passable by vehicle at this time due to erosion caused mainly by spring runoff. CNI road could be restored to an operable condition in a relatively short period of time by a bulldozer.

The north portion of the block is accessible from the north via the Ewin Creek road. This road is maintained and is in good condition. Again, this road follows the valley floor and access to the project area is gained on foot by climbing the north or east-facing slopes.

A third road, Winch Creek road, enters the area on the west side of Ewin Pass Ridge from the west. "Dip Road" leads from Winch Creek road into the Ewin Pass block. This road is in very poor condition at this time and is impassable when wet. The distance from the Ewin Pass Block to the Sparwood/Fording rail line via Winch Creek road is approximately 8 kilometres. From that point it is approximately 27 km to the proposed Line Creek plant site.


Mt. BANNER
(WEST)
(EAST)
EWIN PASS
Mt. MICHAEL
(WEST)
(EAST)
SHELL CANADA RESOURCES LIMITED
DEVELOPMENT DEPARTMENT - COAL
NORTH CENTRAL BLOCK
B.C.
FIGURE 6
AUTHOR: J. FISHER
SCALE: 1:50000
DATE: JAN 1979

4.5 Topography

When considering the physical topography of the North Central Block one must view the Line Creek project area, and the North Central Block area, as a single unit. Though a comparatively narrow valley separates the Line Creek project area from the North Central Block area they are in fact two segments of a single overall geologic and geographic unit. (Figure No. 6)

The whole unit has the form of an elongated wedge with the apex being the southerly oriented nose of the Line Creek project area. The unit is separated from the surrounding mountains by Line and Ewin Creeks on the east and north, and by Grace and West Line Creeks on the west and south.

Maximum relief is between Line Creek at 1585 metres (5200 feet) A.S.L. at the confluence of Line and Tornado Creeks and the peak of the Block at 2582 metres A.S.L., (8471 feet) giving a relief factor of 997 metres, (3271 ft.).

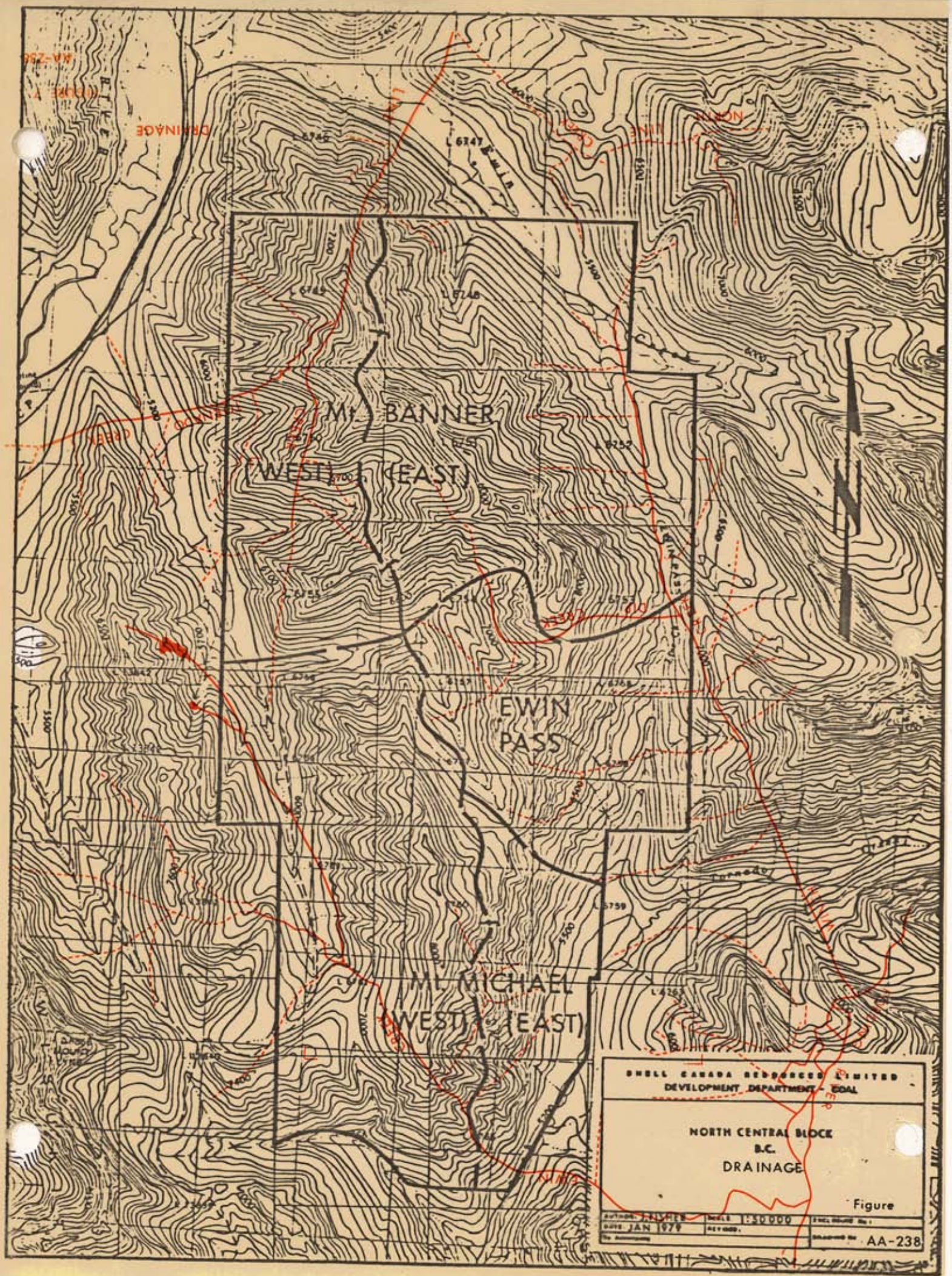
An area, which has been designated, "Ewin Pass" is a sub-unit of the total block. It forms a relatively wide saddle which divides the block.

A ridge extends along the entire length of the Mt. Michael Block and is on a roughly north/south orientation. A second major ridge extends along the length of the Mt. Banner Area.

Secondary ridges, perpendicular to the major ridges, extend to the east and west along the entire length of all areas. Almost all of these secondary ridges have shoulders formed by the more resistant rocks.

As one ascends the mountain, and approaches the higher elevations, the sides become very steep to vertical. In many locations alpine climbing equipment and techniques must be employed if one is to examine and measure the strata in these areas. This is particularly necessary in the area on the east-facing slopes below the peak of Mt. Banner, and Mt. Michael (West).

A wide, ($\simeq$ 1 km), valley runs the length of the block on a bearing of 340$^{o}$. It conforms to the axis of the Fording syncline.



Mt. BANNER
(WEST)
(EAST)
EWIN
PASS
Mt. MICHAEL
(WEST)
(EAST)
SHELL CANADA RESOURCES LIMITED
DEVELOPMENT DEPARTMENT - COAL
NORTH CENTRAL BLOCK
B.C.
DRAINAGE
Figure
JAN 1979
1:50000
AA-238

4.6 Drainage

The project area is drained by four major perennial streams. These are: Line Creek which drains the S.E. portion of the area, Ewin Creek which drains the N.E. portion, Winch Creek which flows northwest through the major valley to the west of Mt. Michael and Ewin Pass areas, and Dip Creek which drains the Ewin Pass block. All of the above streams are at least of 3rd order magnitude. (See Figure No.7)

Virtually every gully contains an ephemeral or intermittent stream. These streams will prove to be of importance where they cut through road beds. They are very vigorous in the late spring/early summer run-off period.

## 4.7 Climate

Though no weather records are available for the area of interest we have the benefit of C.N.I. Ltd.'s experience in the Line Creek Ridge area (1968 - 1970). They observed a maximum of about 0.76 m of snow on the ground at higher elevations.

The relatively small volume of snow in our area is probably related to the prevailing winds which are from the west. This flow of weather from the west would allow the snow to fall in the Elkford area, on the west side of the valley of the Elk/Fording Rivers, as it clears the higher elevations to the west of Elkford. It may also be that the winters of 1968 - 70 were of unusually light snowfall in this area.

Accummulations of snow in cirques on the leeward side of the ridges in the North Central Block have resulted in avalanches down paths that are now well delineated and may be readily seen on the aerial photographs. These paths also channel most of the spring runoff.

S.J. Schofield, (1909), in his paper, "RECONNAISSANCE IN EAST KOOTENAY, B.C.", speaks of the climate as being characterized by, "dry summers, rather long winters, and wet seasons in May and November." On the whole I tend to agree with him. However, like most mountain pass areas, it is extremely difficult to make any firm and unarguable statements about the weather there other than to say that it varies rapidly, locally, and seasonally. During the field season, May-September

1978, the project area appeared to receive an inordinate amount of rain, as well as snow and hail in June, July and August. The temperature varied between $0^{\circ}$ to $26^{\circ}$C in this period. This may be a function of altitude/temperature variations.

The valley, at the base of this block, is some 570 m (1870 ft.), higher in elevation than our base in Sparwood, some 27 km distant. This resulted in many disappointing trips. When the weather in Sparwood was marginally acceptable for field work it was frequently found that it was raining heavily in the Ewin Pass Area, or that dense cloud was down to ground level in the valley there.

## 4.8 Vegetation

The area is typical of most alpine environments in south-eastern British Columbia.

The lower slopes of the North Central Block are covered by a dense growth consisting of fir and spruce trees and a very thick undergrowth. With increasing altitude the trees decrease in size and number until, in the higher elevations, the vegetated slopes are almost entirely grass covered.

The timber on the lower slopes is of some commercial value and should be evaluated by our personnel connected with that operation.

# 5.0 WORK DONE IN NORTH CENTRAL BLOCK

## 5.1 Work Done Prior to 1978

In 1903, Mr. John Ewin staked for himself and 93 other people, 55 040 acres that he believed to contain coal. These lands were apparently taken up in the interest of Mr. J. Brown and Mr. A. Laidlaw. In 1903, with the aid of new capital, these two men incorporated the Imperial Coal and Coke Company under the laws of the Province of Quebec.

In 1904, their claims were surveyed by a provincial land surveyor. In the same year, the B.C. provincial legislature granted a charter to the Fording Valley Railway Company. In 1906, this company made a survey and prepared cross sections as far as the Fording River on the proposed route from Michel, B.C. to Okotoks, Alta. No further work is believed to have been done on this proposed railway.

The Imperial Coal and Coke Company did some development work in tunnelling, surveying, trail cutting and making surface openings on the coal seams.

A total of approximately 1 263 feet of tunnels were driven in nine separate seams in Banner Mountain; a 40 foot tunnel and several slopes 15 to 20 feet long were driven in seams in Lone Mountain. There is said to have been several tunnels and some trenches dug in on Coal Seams on Eagle Mountain on Lots 6695 and 6696.

Three slopes were also driven in Bare Mountain to 120, 130, and 165 feet respectively. The dumps of material from these slopes are still evident although the slopes themselves have caved.

In his report of August 1909, J. McNeil estimated it would cost $52,000 a year to hold this property. About this time, the Union Pacific Coal Company decided to secure control of the Imperial Coal and Coke Company by purchasing the latter Company's outstanding capital stock. They discharged all the outstanding obligations of the Imperial Coal and Coke Company, which a statement shows as having amounted to $559,502.21 on December 31, 1922. After acquiring control, the Union Pacific Coal Company ordered the mine openings sealed and no further development work was done.

In August 1927, Messrs. Eugene McAuliffe, George W. Evans, and F. V. Hicks, visited the Imperial Coal and Coke property. They advised dropping the property for the following reasons:

1. Remote location from their Union Pacific Railway System.
2. Possibility of hydro electric power replacing coal in the near future.
3. Difficult and costly mining conditions.
4. Necessity of constructing an expensive railway to the property.
5. Possibility of too much competition for the limited market available.
6. High existing assessed value of the land resulting in a large tax levy.
7. Questionable number of good timber, mine and town-site locations with good supply of water all year round.

## RESERVES

TABLE 1

## PROVEN AND PARTIALLY PROVEN

## EWIN PASS

SUMMARY OF COAL TONNAGES, AS OF MAY 1, 1973

| SEAM | MET. COAL ST | | OXIDIZED COAL ST | | TOTAL COAL ST | |
|---|---|---|---|---|---|---|
| | P | PP | P | PP | P | PP |
| 8 | 5,369,880 | 1,522,470 | 947,620 | 268,660 | 6,317,500 | 1,791,130 |
| 7 | 8,192,710 | 5,595,340 | 1,445,700 | 987,470 | 9,638,410 | 6,582,810 |
| 6 | 416,400 | 340,080 | 73,480 | 59,970 | 498,880 | 400,050 |
| 5 | 1,031,900 | 1,010,810 | 182,080 | 178,370 | 1,213,980 | 1,189,180 |
| 4 | 2,173,000 | 2,694,230 | 383,480 | 475,440 | 2,556,480 | 3,169,670 |
| TOTAL | 17,183,890 | 11,162,930 | 3,032,360 | 1,969,910 | 20,216,250 | 13,132,840 |

TOTAL WASTE - 301,894,000

SR - 9.05

## RAW RECOVERABLE SHORT TONS*

| Ewin Pass | | | | RATIO ** |
|---|---|---|---|---|
| Proven | 17,200 | 3,000 | 20,200 | |
| Partially Proven | 11,200 | 2,000 | 13,200 | 9.1 |
| | 28,400 | 5,000 | 33,400 | |

* Based upon 81% mining recovery

** Total waste in cubic yards mining losses per short ton raw recovered coal.

Almost all work that has been done in the past twenty-five years in the North Central Block was done by Crows Nest Industries Limited in the period 1968 - 1970.

In their work here, their target was the Ewin Pass Area, where substantial reserves of coal are known to exist in a dip-slope situation. (Table 1)

Aerial Photographs & Photogrammetric Mapping

- 1968 - aerial photos 1:36 000 (1"=3000')
  - aerial photos - YC-1587, 1:24 000 (1"=2000') used to construct 1:2 400 (1"=200') topographic maps with 10 ft. contour interval
- 1970 - aerial photos - YC-1827, 1:24 000 (1"=2000')
  - YC-1845, color transparencies 1:12 000 (1"=1000')

Geological field mapping was carried out by CNI and mapping was done on air photo enlargements. This was later transferred onto topographic maps.

Nine reverse-circulation rotary holes were drilled by CNI with truck-mounted rigs. All holes were vertical and were logged geophysically. A total of 2402.4 m was drilled.

The work done here consisted of an access road being driven into, and slightly beyond, the Ewin Pass Area. This road leaves the valley of Line Creek via the unnamed valley which separates the Line Creek project area from the North Central Block. The road ascends the mountain very gradually until it reaches the saddle in the Ewin Pass

Area. It was extended along the top of the east-facing escarpment and some several hundreds of metres into the Northern Area. Roads were also extended down the west-facing dip-slope of the area to allow drill rigs to reach the drilling sites.

As the road progressed upwards from the Line Creek valley secondary road cuts were made down-slope, generally perpendicular to the line of advance, to the top of the basal sandstone. These side cuts enabled the geologist to maintain his stratigraphic position within the coal bearing member. The main access road generally follows the outcrop of the number seven seam.

The drilling program combined with field mapping of the Ewin Pass Area gave sufficient data to allow geological maps, cross-sections and tonnage estimates to be made.

In 1975 the John T. Boyd Company (Mining and Geological Engineers) of Pittsburgh, Penn., U.S.A. submitted a report to Crows Nest Industries Ltd. in which they included a drill hole Summary of the Ewin Pass area, (Table 3, in pocket). This is connected to the work performed by Crows Nest Industries Ltd. in the period 1970-1972.

STATISTICAL SUMMARY OF STRATIGRAPHIC SECTIONS

Table No. 2

| Area | Strat. Section No. | Length Trenched (m) | Measured (Detail) (m) | True Th. Exposed (m) | Coal Th(aggregate) (m) |
|---|---|---|---|---|---|
| Mt. Michael (E) | MR 4 (A) | 112 | 140 | 130 | 43 |
| | MR 4 (B) | 13 | 65 | 46 | 7 |
| | MR 5 (A) | 114 | 140 | 134 | 45 |
| | MR 5 (B) | 62 | 264 | 244 | 10 |
| | MG 6 | 34 | 99 | 84 | 15 |
| | MG 7 (A) | 62 | 224 | 198 | 46 |
| | MG 7 (B) | 11 | 56 | 50 | 2 |
| | MG 7 (C) | 15 | 124 | 110 | 9 |
| | MR 8 | 4 | 23 | 21 | 12 |
| | MR 9 | 8 | 44 | 40 | 21 |
| Mt. Michael (W) | MR 11 (N) | 19 | 414 | 390 | 39 |
| | | 454 | 1593 | 1447 | 249 |
| | ER-1 | | | | |
| | ER-11 | | | | |
| Ewin Pass | ER-12-11 | 28 | 258 | 234 | 29 |
| | ER-14 | 6 | 44 | 40 | 3 |
| | ER-17-16 | 14 | 194 | 176 | 11 |
| | ER-8 | 12 | 89 | 81 | 14 |
| | | 60 | 585 | 531 | 57 |
| | YH-1 | | 30 | 30 | 5 |
| Mt. Banner (E) | MB-Peak | 30 | 1651 | 1500 | 8 |
| Mt. Banner (E) | MB 1 | | 44 | 40 | 14 |
| | | 30 | 1725 | 1570 | 27 |

## 5.2 Work Done In 1978

Work in 1978 was aimed at defining target areas for future development by increasing our knowledge of the geology and structure of the area.

Preparation began in our Calgary office in May of 1978 with a literature search, study of reports on this and adjacent areas, study of aerial photographs and planning for the coming field season.

1978 PROGRAM

o Aerial Photographs And Photogrammetric Mapping(by SCRL - NW Survey)

1978 - aerial photos - NW 55678 1:40 000 (1"=3,333')
(high level)
- NW 61778 1:20 000 (1"=1,667')
(low level)

- These air photos were used in construction of 1:5 000 and 1:2 000 photogrammetric maps with 5 m and 2 m contour intervals respectively. (See Attachments I and II filed separately).

Geologic structure was mapped, stratigraphic sections measured and stratigraphy correlated and mapped. (See Table No. 2)

Mapping was carried out using aerial photographs of scale 1:24 000 and 1:12 000, which had been flown by Spartan Air Services, and NTS topographic maps, (enlarged to scale 1:10 000).

The area mapped was chiefly the exposed strata of the east-facing slopes with additional measured sections down the secondary ridges running off of the main ridges.

Where intervals of the stratigraphic sections were covered, by soil or rock debris, trenchers were used to expose the underlying rocks.

Geologic data were recorded on the aerial photographs and later transferred onto enlarged photographs, (scale 1:5 000).

Twenty-three stratigraphic sections were measured, for a total length of 3.8 km, and 14 trenches were dug.

At present eight seams have been identified which correspond to those seams of the Line Creek Area. The seams range in thickness from 2 to 12 m. In the Mt. Michael area a coal zone thickened to up to 60 m was mapped for approximately 1.2 km along strike.

At the present time it is estimated that approximately 20 percent of the project area has been mapped in a general form.

The new photographs were not available during the period when the field work was being done. All data recorded on the older photographs have now been transferred to the new photos. This was done after returning from the field. The final map sheet on the 1:2 000 scale was received in Calgary on February 5th 1979. The 1:5 000 maps have not been received at the time of writing.

Details of costs incurred may be found in Appendix B, with Application to Extend Term of Licence.

## 5.3 Manpower

On the whole the team assigned to the North Central Block, consisting of four men, was in the field for a total of 92 days or 368 man/days. The number of personel was increased in August when four trenchers were assigned to the N.C.B. for the period of August 1st to 23rd. During this time period they worked thirteen days on the N.C.B. Prior to this two trenchers had worked a total of 10 days. This gives an aggregate of 492 man days of work done on the N.C.B. This figure does not include the helicopter back-up which was required on most days.

The work consisted chiefly of geological mapping of the area. This included the measuring of approximately 3.8 km of stratigraphic sections, the posting of all recorded data to enlarged air photographs for later transferal to geologic-photographic maps.

The work also involved the sampling of the coal seams present, and transportation of the samples to the laboratory in Fernie for analysis. Samples were also collected and sent to the Calgary office for analysis and use in the preparation of maturity maps of the area.

Where intervals of stratigraphic sections were covered, trenchers were employed to uncover these sections. This work was supervised by one of Shell's field party members who worked in the vicinity of the trenching being done.

On almost all days when work was being done north of Mt. Michael it was necessary to lift all working members up onto the work area by helicopter. When poor flying weather, or unavailability of the helicopter prevented this, the party members climbed the mountain to the work area. This usually required a minimum of 2.5 to 3 hours going up and 2 hours to descend. Weather conditions were such, during this field season and at this altitude, that, on many occasions, the helicopter was unable to lift the field party. This made it necessary either to climb the mountain or return to the field office, depending upon the severity of the weather.

Table No. 3 TABLE OF FORMATIONS

| Era | Period or Epoch | Group Formation | Lithology | Thickness (feet) |
|---|---|---|---|---|
| | | Disconformity | | |
| Mesozoic | Lower Cretaceous | Crowsnest Formation | Trachyte agglomerate, tuff, volcanic-rich sandstone, mudstone, conglomerate | 500 |
| | Lower Cretaceous, may be younger | | Trachyte, syenite, volcanic breccia | |
| | Lower Cretaceous | Blairmore Group | Grey and greenish grey sandstone, arkosic sandstone, green and red mudstone; minor brown limestone | 1,800-3,750 |
| | | Disconformity | | |
| | Jurassic and (?) Cretaceous | Kootenay Formation | Dark grey, carbonaceous sandstone and conglomeratic sandstone, siltstone, shale; coal | 500-1,700 |
| | Jurassic | Fernie Group | Grey calcareous shale, shaly limestone, silty limestone; dark grey shale, limestone; sandstone | 1,250 |
| | | Disconformity | | |
| | Triassic | Spray River Formation | Grey dolomitic siltstone and sandstone; brown siltstone and silty shale | 300? |

# 6.0 GEOLOGY

## 6.1 Regional Stratigraphy

The Kootenay Formation of Upper Jurassic - Lower Cretaceous age is the coal-bearing sequence of south-eastern B.C. It is a thick sequence of clastic sediments representing delta progradation over marine shales, siltstone and sandstones of the Jurassic Fernie Formation. (Table No. 3)

Deposition was initiated by an epeirogenic uplift of the source area in early phases of the Columbian Orogeny in Late Jurassic time. The Kootenay section thickens from east to west; the source of sediments being southwest and the shoreline on the east and northeast. Its thickness within the Upper Elk Coal Field ranges up to 1100 m.

The Kootenay Fm. can be subdivided into three main units. (Figure No. 8) A basal, cliff-forming "Moose Mountain Member" is composed predominately of sandstones with minor siltstones and shales. It is a prograding sequence of delta front sheet sands, barrier bars and tidal channel deposits.

The middle, "Coal-bearing Member" is generally in sharp contact with the underlying Moose Mountain (sandstone - coal, or sandstone - bioturbated silty shale). It consists of alternating beds of sandstone, shale, siltstone and coal representing prograding delta plain environments. The Coal-bearing Member is 245 m - 860 m thick, including 6 m to 61 m of coal in the south contained within 2

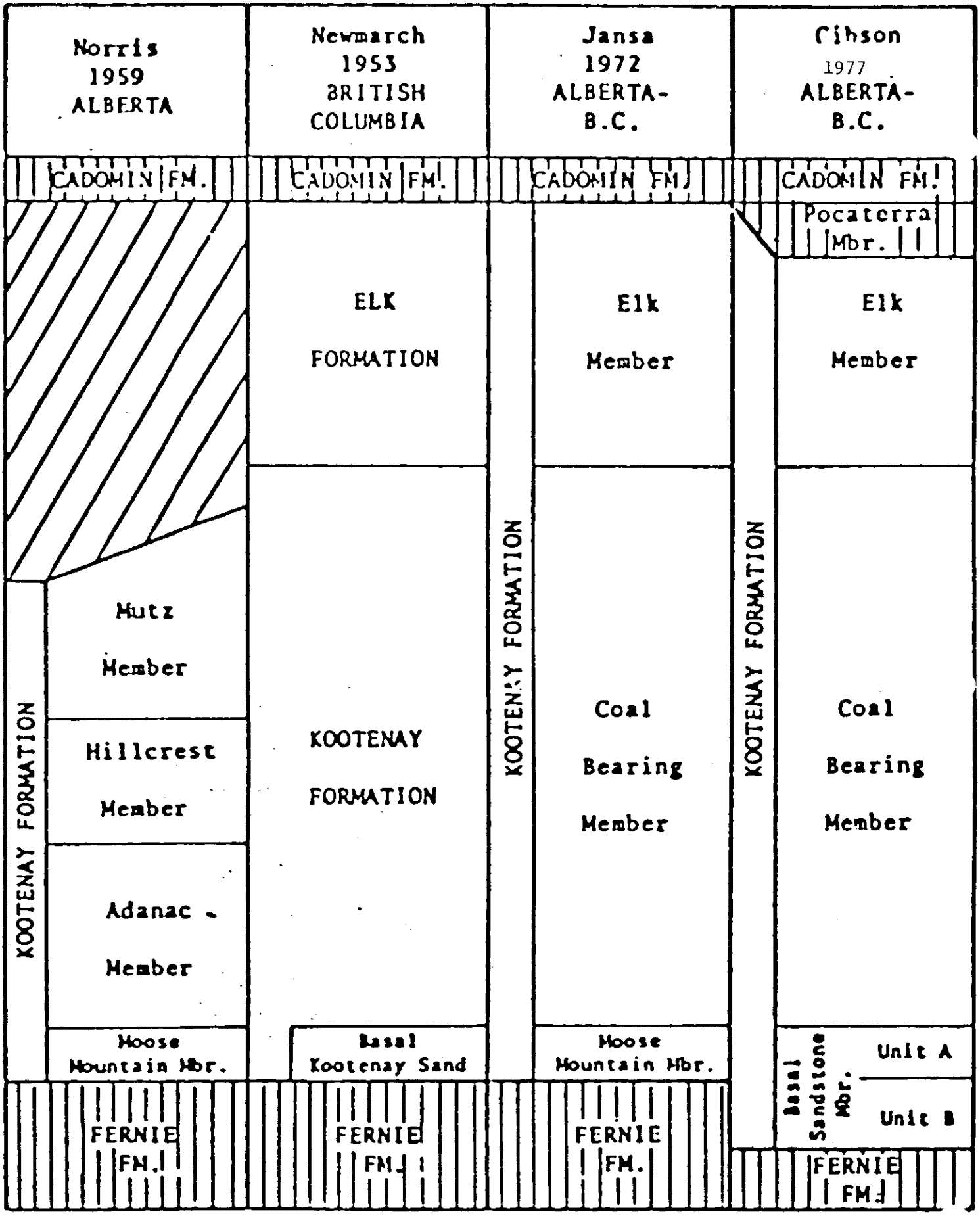



Figure 8

Nomenclature chart illustrating and comparing the main Kootenay and stratigraphically adjacent formations and members recognized

D. W. GIBSON

BULLETIN OF CANADIAN PETROLEUM GEOLOGY
VOL. 25, NO. 4 (AUGUST 1977), P. 787-791

to 8 seams, and up to 90 m of coal in 23 seams on the north.

The upper portion of the Kootenay Fm., the "Elk Member", consists of alternating sandstone, siltstone, shale and conglomerates with minor lenticular coal beds. It represents progradation of the alluvial plain over the delta plain coal-forming environments.

The upper contact of the Kootenay is an erosional surface. It is overlain by the Cretaceous Blairmore Group, beginning with rejuvenated piedmont-plain deposits of the Cadomin Formation (Cadomin Conglomerate).

Only erosional remnants of the Kootenay Formation are preserved in the south of the Fording Syncline. A $10^{o}$ north plunge on the syncline preserves an increasing thickness of Kootenay section to the north. Faulting and folding has caused some repetitions of the section and thickening of the coal seams.

Shales are generally dark gray to black, slightly calcareous, lensy and thin. Two notable exceptions occur persistently at 12 m and 16 m below the top of the Moose Mountain Member. Their thickness ranges from 0.2 m to 1.0 m and lithology varies from carbonaceous shale to bright coal. These beds appear as two slightly recessive layers in the Moose Mountain Member, especially noticable along the west side of the ridge.

The lower contact of the Moose Mountain Member is transitional into Passage Beds (Fernie Formation) while the upper

contact is generally sharp below the #10A seam of the Coal-bearing Member. Above #8 seam, sandstones in the Coal-bearing Member are less common, thinner, and more variable. Their upper and lower contacts tend to be gradational, compared with the relatively sharp sandstone contacts below #8 seam.

The middle Coal - bearing Member is an interbedded sequence of shale, siltstones, sandstones and coal.

Shales range from carbonaceous to silty and dark gray to black in color. Thin laminae of siltstone or sandstone and coaly stringers or wisps are common throughout the section. In road cuts (constructed between 1968 and 1971) the carbonaceous shales are almost completely sloughed over whereas the silty shales are often still partially exposed.

Siltstones are interbedded with shales and sandstones or occur as the transition from one to the other. Road-cut occurances are often still well exposed.

Sandstones are fine-to-medium grained and tend to become coarser down section. Laminar bedding, cross-bedding and soft-sediment deformation are seen throughout. The lower 75 m of the Coal-bearing Member (below #8 seam) has a higher proportion of thick, persistant sandstone units, some of which are easily correlated in drill holes. Petrographic analysis of the cliff-forming

quartzite between #8 & #9 seams (G Wilson, 1976) is as follows:

| | | |
|---|---|---|
| Quartz & Chert | - | 73% |
| Cement - Silica | - | 20% |
| Matrix | - | 7% |
| Accessory Minerals | - | Trace |
| | | 100% |

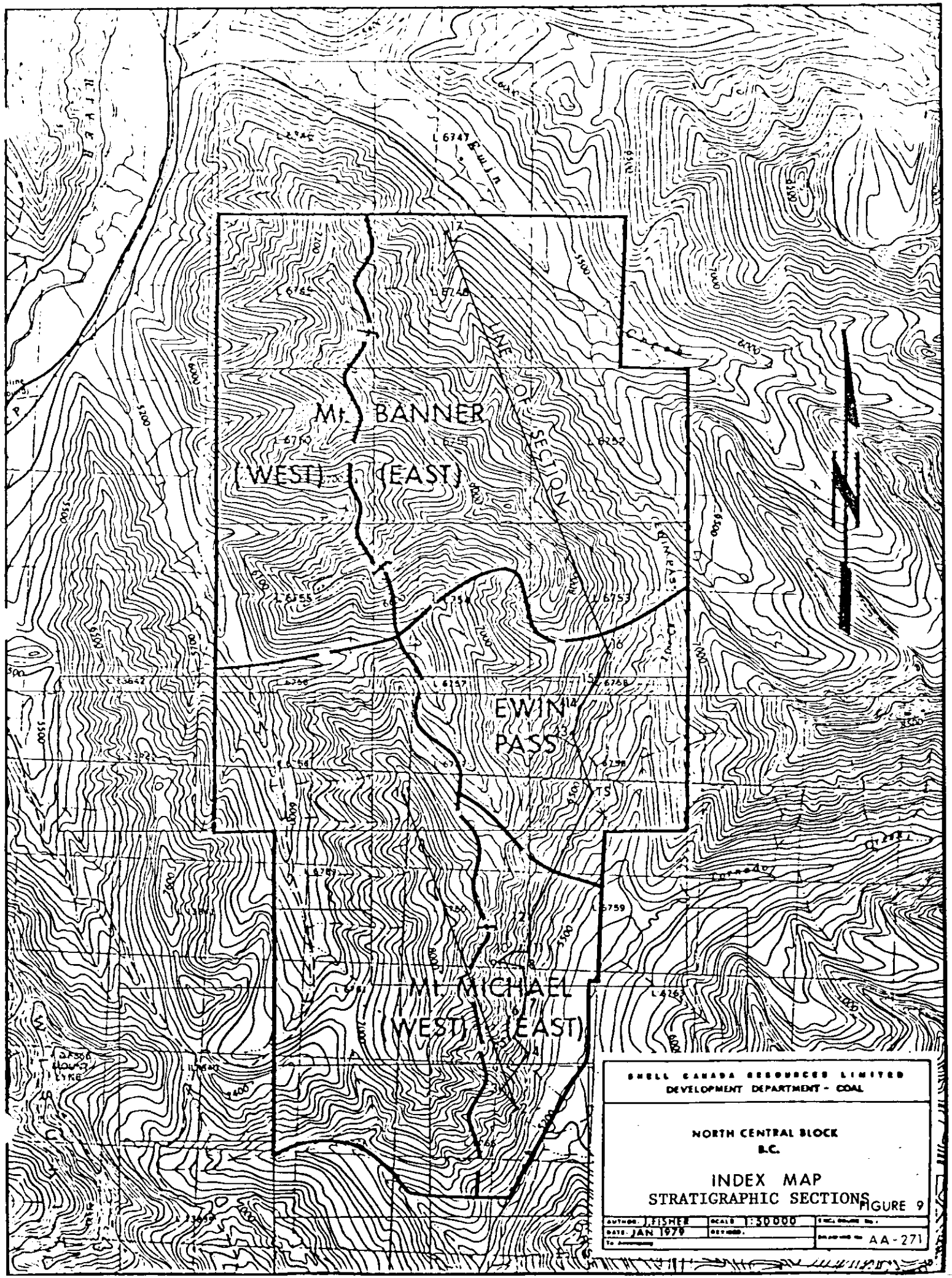
Coal seams are numbered from the top #1, #2, #3, #4, #5, #6, #7, #8, #9, #10B, #10A, with 45% of the coal thickness occurring in the lower four seams. The main mineable seams are:

- #4, two coal seams separated by a shale parting. Average thickness is 8.0 m.
- #6, two coal seams separated by a shale parting which ranges in thickness from zero to 13.0 m. Average thickness is 2.4 m.
- #7, maintains a regular thickness of about 6.0 m.
- #8, is the thickest seam, averaging 12.5 m. Its stratigraphic and geophysical characteristics are very consistent. Thickness variations are probably due to structural disturbance (faulting and/or drag folding).
- #9, maintains a regular thickness averaging 9.8 m.
- #10B, maintains a regular thickness (average 4.5 m) except where faulted. Its upper contact is inter-bedded carbonaceous shale and shaly coal and is

therefore not as sharp as the basal contact.

- #10A, maintains a regular thickness (average 2.8 m). Its basal contact is often sandy coal or coaly sandstone.

Thickness values given are from within the Ewin Pass Block. The consistent nature of stratigraphy from #8 seam down to the Moose Mountain Member indicated an inter-deltaic coastal marsh or lower deltaic-plain inter-distributary depositional environment. More variable stratigraphy above #8 seam indicates deposition in flood-basin swamps (Gibson, 1977).


Mt. BANNER
(WEST)
(EAST)
LINE OF SECTION
EWIN PASS
Mt. MICHAEL
(WEST)
(EAST)
SHELL CANADA RESOURCES LIMITED
DEVELOPMENT DEPARTMENT - COAL
NORTH CENTRAL BLOCK
B.C.
INDEX MAP
STRATIGRAPHIC SECTIONS
FIGURE 9
AUTHOR J. FISHER
SCALE 1:50 000
DATE JAN 1979
AA-271

## 6.2 Stratigraphy - North Central Block

The target formation is the Upper Jurassic - Lower Cretaceous Kootenay Formation. In the stratigraphic succession of the area it is located above the Passage Beds of the Upper Jurassic Fernie Formation and beneath the Cadomin Formation of the Lower Cretaceous. (Table No. 2)

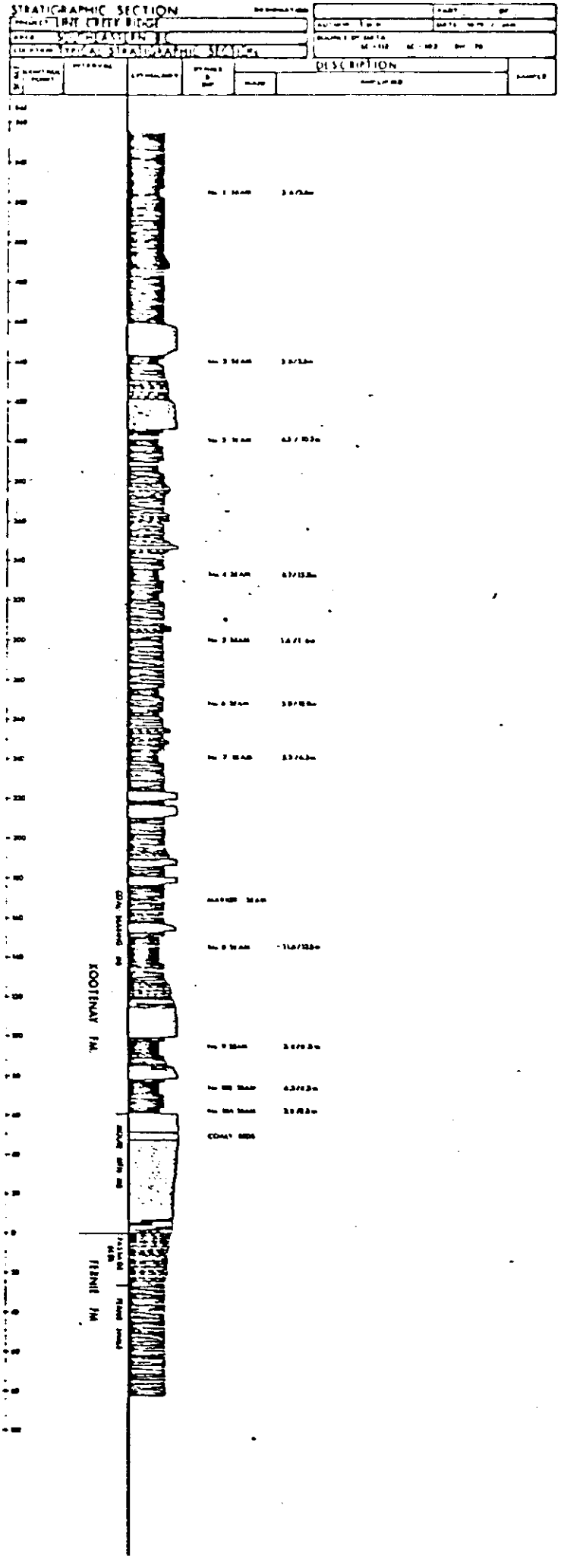
For the purposes of this report we have adopted Gibson's (1977 - 1A) divisions of the Kootenay Formation. He divided it stratigraphically upwards as: Basal Sandstone Member, Coal Bearing Member, and Elk Member. The Basal Sandstone Member is further subdivided into units "A" and "B", ("B" being the lower unit). (Table No. 3) (Figure No. 8).

The stratigraphy of the Kootenay Formation in the North Central Block is well exposed in the uplifted eastern face of the block.(Fig.9 & 24)

### Basal Sandstone Member

The Basal Sandstone Member is repeated throughout most of the North Central Block with an exposed thickness of 45 m on Mt. Michael. The underlying Passage Beds are also exposed at several locations in Mt. Michael and Ewin Pass. The basal sandstone member is readily seen over almost the entire length of the Mt. Michael sector. In the Ewin Pass sector faulting has taken place and it was difficult to determine which sandstone was the top of the basal sandstone. (Figure No. 10)

In the Mt. Banner area the basal sandstone is covered by soil and vegetation but it is still possible to map it, using aerial photographs, due to it's topographic expression.




**Crows Nest Resources Limited**

EXPLORATION

SOUTHEASTERN B.C.

LOCAL STRATIGRAPHY

FIGURE 10

| | | |
|---|---|---|
| Hannah | SCALE 1 : 3000 | |
| March/79 | | MJ - 18 |

The basal sandstone member A, consists of a fine-to-medium grained quartzose sandstone. It is very resistant and forms a prominent cliff or ridge wherever it is exposed. The lower unit, "B", is a lighter grey color than the upper unit.

Coal Bearing Member

The coal bearing member is found directly above the basal sandstone. It consists of a thick succession of grey to greyish-brown, interbedded, carbonaceous-argillaceous sandstones, siltstones, mudstones, shales, and thin to thick seams of low-to-medium volatile bituminous coal.

In the Mt. Michael (E) area seams 10A, 10B, and 9 have been thickened by faulting to a total of 61 m, or roughly 4 times the normal aggregate thickness. (See Stratigraphic section MR-4 (A)). This includes parting material.

Though seams 8 and 7 are also faulted it does not appear that they have thickened or thinned where they outcrop, but are severely sheared.

The Elk Member overlies the Coal-Bearing Member and the contact is placed at the base of the first major sandstone or conglomerate above the uppermost major coal seam in the Coal-Bearing Member.

Elk Member

The Elk Member consists of a cyclical succession of relatively thin interbedded sandstones, siltstones, shales, conglomerates and thin, (usually 0.5 m), coal seams.

At the peak of Mt. Banner the Elk Member is overlain by a massive conglomerate. This forms the highest point of the North Central Block. This very resistant, cliff forming, conglomerate consists of sandstone and pebble-to-cobble size boulders.

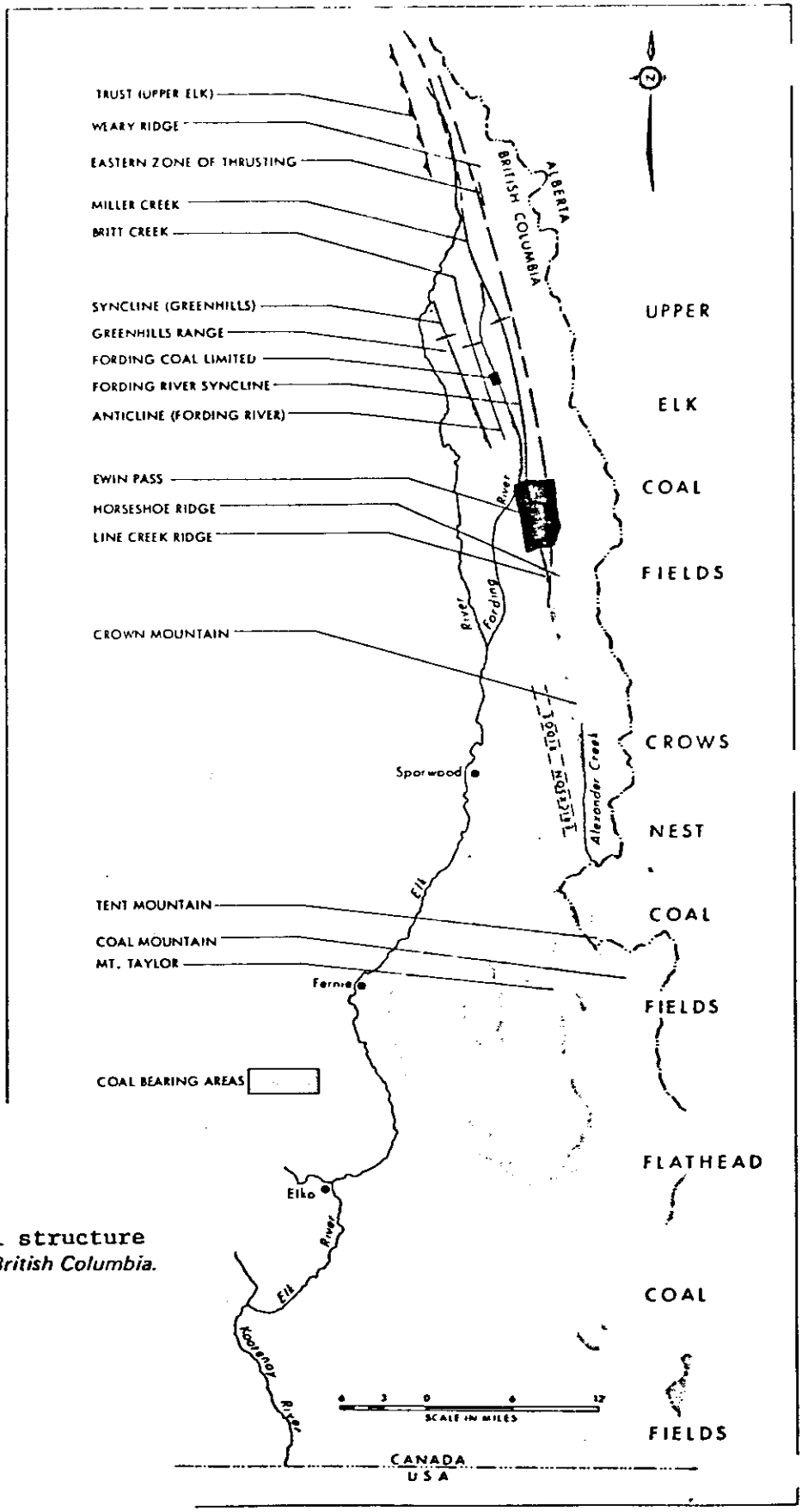



Figure No. 11
Regional geological structure
*Coal basins of southeastern British Columbia.*

## 6.3 Regional Structure

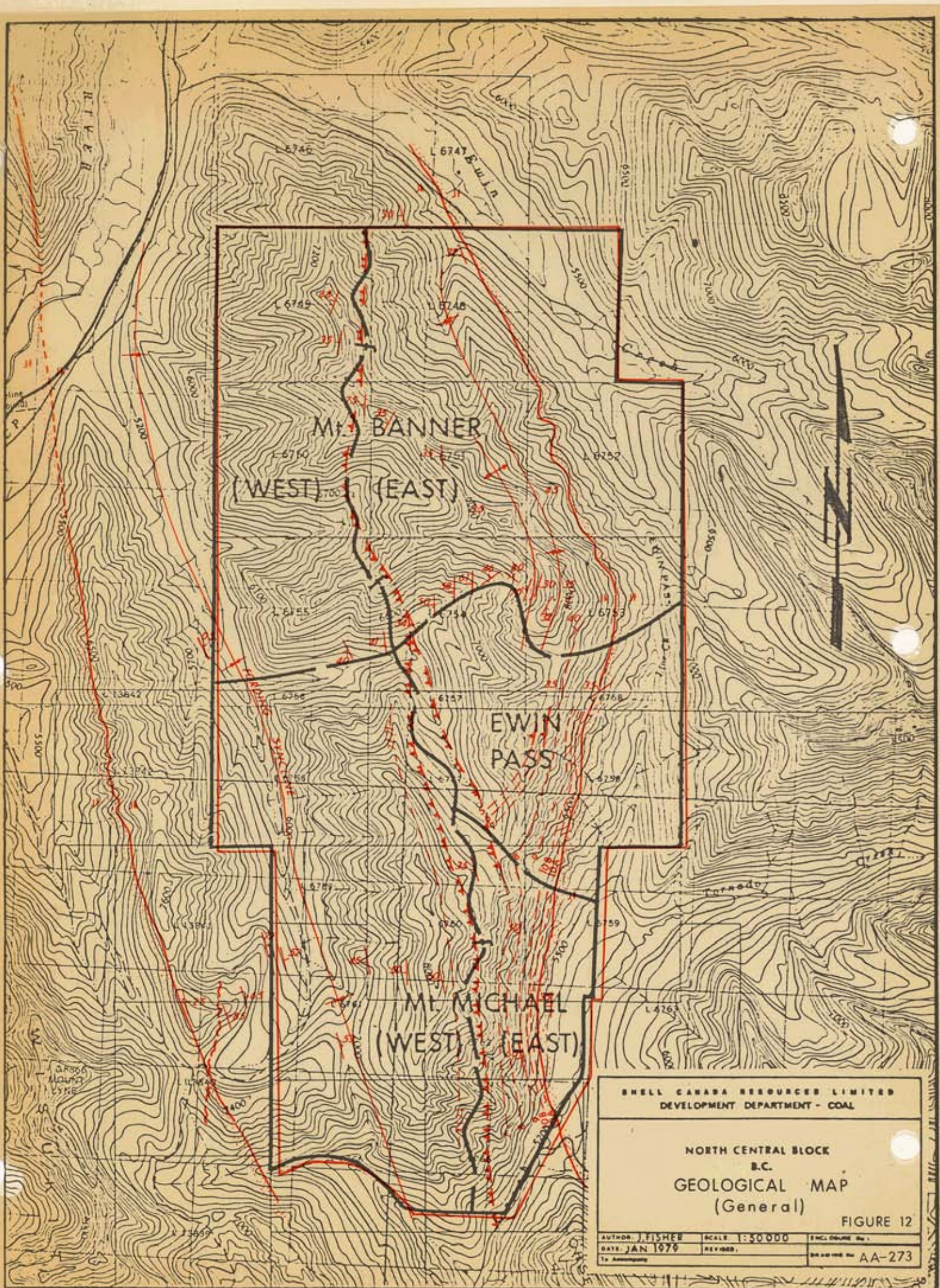
The Coal-Bearing Kootenay Formation occurances of south-eastern B.C. are preserved in north-south trending synclines referred to as the East Kootenay Coalfields (Figure No.11). High structural relief of Paleozoic rocks surrounding the coalfields fades out in relatively incompetent rocks of the Fernie and Kootenay formations. The structure within the synclines is complicated to varying degrees by thrust faults and their associated folds, and also by normal faults. This structural complexity increases towards the thinner, east side of the coalfields where they have been thrust against underlying Paleozoics.

The East Kootenay Coalfields can be subdivided into three coal-bearing areas. From south to north they are the Flathead Coal-field, the Fernie Coalfield and the Upper Elk Coalfield. Since they are all part of the same depositional complex, the subdivision is based on erosional boundaries and structural boundaries.

### Upper Elk Coalfield

The Upper Elk Coalfield is an elongate basin composed of two major synclines (Greenhills and Fording) separated by an anticline and the northern extension of the Erickson normal fault. The eastern, Fording syncline, can be traced northward from Alexander Creek to the Kananaskis Lakes. On its south end, it is symmetric with moderate to steep dips on both limbs. To the north it becomes more asymmetric with a west dipping axial plane, vertical strata on the west limb and moderately dipping strata on the east limb.

On the west side of the Erickson Fault, the Greenhills syncline has been downthrown approximately 900 m. It can be traced northerly up the Elk River valley from Fording Mountain to where it is cut off by the Elk River Thrust. The Greenhills Syncline is slightly asymmetric with a west dipping axial plane.




SHELL CANADA RESOURCES LIMITED
DEVELOPMENT DEPARTMENT - COAL

NORTH CENTRAL BLOCK
B.C.
GEOLOGICAL MAP
(General)

FIGURE 12

| | | |
|---|---|---|
| AUTHOR J. FISHER | SCALE 1:50 000 | ENCLOSURE No. |
| DATE JAN 1979 | REVISED | DRAWING No. AA-273 |
| To Accompany | | |

## 6.4 Structure - North Central Block

Most of the North Central Block is on the east limb of the Fording River syncline. The Mt. Michael (W) sector contains a portion of the west limb and some 5+ km of the synclinal axis. The syncline is asymmetrical with the dip of the west limb being generally much steeper than that of the east limb.

There is strong evidence for faulting along the trend of the synclinal axis in the sudden change in magnitude of the dip of the strata on the east limb. Faulting can be seen in the axial fold of the Fording syncline at the southern end of Mt. Michael. The sudden change of dip of the strata here from almost horizontal to approximately 65 degrees in a few tens of metres indicates that the fault continues northwards along the axial fold line.

The Fording River thrust fault is present in the North Central Block and is mapped from the southernmost portion of Mt. Michael into the Ewin Pass sector. Its trend to the north of Ewin Pass is not known with certainty at this time. Secondary, imbricated, faults related to the Fording River Fault are present throughout the area. Drag folds are also seen throughout the area.

The North Central Block was subdivided on a north south line using the Fording River Thrust Fault as the dividing line.

The dip of the beds in the east limb of the syncline generally decreases as one moves from south to north. In the Mt. Michael (E)

sector the dip varies between 45° - 60°W. In the Ewin Pass sector it is between 30° - 40°W. Readings of the north end of Mt. Banner gave a dip of 32°W. There are local variations, or rolls, throughout the entire area. (Values given are average for the area referred to)

The presence and uplift of the Fording River thrust fault has resulted in seams Nos. 7, 6, 5 and 4 being repeated in the area above and to the west of Ewin Pass in a situation which may be favour-above for an open pit operation.

Most of the coal seams contain very thin shale, or shaly, partings. These partings are frequently carbonaceous to a degree that they must be examined closely to define the thickness of the parting material.

Due to the amount of faulting that has taken place along the bedding planes some of the coal is sheared and pulverized to the consistency of powder. Where it has not been altered by faulting it is hard, competent and shows good cleat. In these undisturbed areas bands of bright and dull coal can be clearly seen in the coal seams.

Thrust faulting along bedding planes has resulted in marked thickening of the coal seams locally as well as the repetition of seams. The angle of thrust of the fault is slightly greater than the angle of dip of the coal seams. (See cross section No. 5,539,600 N) The average dip of the coal seams is about 45°.

Ewin Pass Area

In the Ewin Pass block we have the benefit of 9 drill holes to give us a better picture of the dip and the nature of the coal seams here.

In this area it appears that the No. 8 seam is the one most affected by the action of thrust faulting. It has been thickened from an average of 12.3 m to 23 m.

This block contains at least 9 seams with thickness $\geq$ 1.5 m. The aggregate thickness is 51.8 m. These figures, (CNI's), do not include seams 10B and 10A. Inclusion of these seams may bring the aggregate thickness to 59 m.

The coal here has a dip varying between 30 and 40 degrees to the west. The dip of the coal seams is almost coincident with the slope of the ground surface so that the situation is advantageous for an open pit mining operation.

Seams Nos. 5, 6, 7, 8, 9, 10B and 10A extend northwards from the area drilled by CNI Ltd. so that it may be possible to extend the defined mineable area in that direction. This block deserves detailed examination and mapping. (Geological Photo-Map No.'s 2 & 3)

Mt. Michael (West)

A seam approximately 6 m thick was seen roughly paralleling the main ridge of Mt. Michael with a series of thin, ($\leq$0.5 m), coal seams below it. The Fording thrust fault occurs below it and it is on the uplifted side of the fault. The 6 m seam is tentatively identified

as No. 7 seam. Seams down-slope to the west, (stratigraphically higher), are tentatively identified as seams Nos. 6, 5 and 4. These seams are in a dip-slope attitude and should be examined in detail. (Geological Photo-Map No.'s 2, 5 & 6)

Mt. Michael (East)

In the Mt. Michael (E) sector thrust faulting has taken place along bedding planes. This has resulted in the coal seams being thickened and repeated. In particular seams 10A, 10B and 9 have been thickened from a normal thickness of 2.8 m, 4.5 m, 5.4 m respectively, (aggregate Thickness = 12.7 m), to a gross thickness of 61 m, including parting material. This is an increase of roughly 4 times the normal thickness. The seams here dip approximately $55^{\circ}$ to the west. (Geol. Photo-Map No. 1)

Seam 8 ($\cong$12 m thick) is in place here as are seams 7 ($\cong$5.8 m thick) and 6 ($\cong$5 m thick).

Mt. Banner (West)

Most of the knowledge of the coal in this sector is derived from the examination of the spoil piles, and sampling coal from the reopened adits, of the old Imperial Coal and Coke Co. Ltd. (See Appendix B) They are on the most northerly point of the Mt. Banner (W) sector. Eight seams were opened of which 5 were found to be of coking quality. Though these adits are outside of our licenced area the coal seams present there extend southwards into our property. The seams here are in a dip slope situation so that they deserve close examination.

As the most remote, and least accessible, area of the North Central Block, and as mapping began in the south and worked northwards, this area is the least explored in the block. However, it does contain reserves of coking quality coal and therefore must be mapped in detail. It is as close as 700 metres to the CPR's Sparwood/Fording Spur line. (Geological Photo-Map No.'s 4 & 8)

Mt. Banner (East)

The Alexander Creek synclinal axis which transects the peak of Mt. Banner (E) has been traced on aerial photographs into the axis of a valley to the north of the peak. There is sufficient room in the east wall of this valley for seams 8 through 10A to be present in a dip slope situation with a low overburden/coal ratio. (Figure No. 13)

Seams 9, 10B and 10A were measured some 400 m to the west of the synclinal axis mentioned above so that faulting is assumed to be present between these two points.

Eight hundred metres to the west of the peak of Mt. Banner an anticlinal structure is seen and mapped. From this point westwards to the axis of the Fording River syncline, the dip of the strata is to the west. (Geological Photo-Map No. 4)

## 7.0 COAL QUALITY

The coal is medium volatile (25 - 29% d.a.f.) bituminous, low (0.6%) in sulphur, exhibits good coking characteristics, (F.S.I.= 5 to 8). Eighty-five percent of the reserves are expected to be of metallurgical grade. Its Heat Value is 6400 KCal/Kg at 23% raw ash or 7600 KCal/Kg at 12% washed ash.( Enclosures)

The coal in this area has been known and mined since the early years of this century. Adits were driven into the northwest sector of Mt. Banner (West). The analytical data derived from this work are given in Appendix A(1).

Mr. N. Elphinstone,(1951),in his report on the area,sampled coal in the Mt. Michael (East) area. The analytical data are presented in Appendix A(2).

The drilling program conducted by CNI in 1970 resulted in data aquisition sufficient to estimate tonnage and develop a mine plan. The analytical results of the coal cuttings is given in Appendix A(4).

Coal from the thickened seams of Mt. Michael (East) sector was sampled in 1978 and analysed by Loring Laboratories Ltd. of Calgary. The analytical data are presented in Appendix A(3).

Appendix A

## COAL ANALYSIS

In the North Central Block we have analytical data, from three areas, of samples which were taken in a variety of ways and over a great span of time, (71 years).

In 1907 Mr. J. McNeil reported on coal taken from the Imperial Coal and Coke Co.'s adits on the north west corner of Mt. Banner (West). These were analysed by Von Schulz and Low of Denver, Colorado and the results were as follows: ('B' being the highest seam stratigraphically),

A(1) ANALYSES BY VON SCHULZ AND LOW
Denver, Colorado

J. McNeil 1907 (Report 1 pp.4)

| Sample | Seam | Thickness | Moisture | Vol. Comb. Matter | Fixed Carbon | Ash | Remarks | Length of Tunnel |
|---|---|---|---|---|---|---|---|---|
| B | B | 10-12 ft. | 5.11 | 28.38 | 59.91 | 5.60 | Non coking | |
| F | F | | 0.85 | 24.70 | 63.73 | 10.72 | Cokes | |
| G-1 | G) | thick seam | 1.15 | 24.56 | 69.11 | 5.18 | Poor coke | |
| G-2 | G) | | 1.05 | 24.25 | 62.81 | 11.89 | Cokes | 120 |
| G-3 | G) | | 0.80 | 20.60 | 59.90 | 18.70 | Semi coking | |
| I | I | 5 feet | 0.90 | 23.15 | 60.70 | 15.25 | Cokes | 125 |
| J | J | 3 feet | 3.30 | 25.25 | 62.10 | 9.35 | Non coking | 25 |
| K | K | 4' 8" | 0.96 | 22.26 | 66.53 | 10.25 | Cokes | 150 |
| Q | Q | 9 feet | 1.00 | 21.38 | 67.62 | 10.00 | Semi coking | |
| R | R | 7 feet | 0.86 | 19.45 | 66.90 | 12.77 | Semi coking | 100 |

In 1909 McNeil had lengthened four of the tunnels and re-sampled the coal. The analytical data derived show some marked changes

but no reason is advanced. It might possibly be the result of more selective sampling techniques. The data are as follows:

J. McNeil 1909 (Report 2 pp. 40)

| Sample | Seam | Thickness | Moisture | Vol. Matter | Fixed Carbon | Ash | Remarks | Tunnel |
|---|---|---|---|---|---|---|---|---|
| K | B | 10-12 ft. | 5.01 | 26.29 | 61.05 | 7.65 | | 51 |
| G | F | - | 1.06 | 24.06 | 66.54 | 8.34 | Coking | 196 |
| M | G | Thick | 1.50 | 21.46 | 61.35 | 15.69 | | 184 |
| F | I | 5 feet | 1.31 | 24.64 | 70.01 | 4.04 | Coking | 185 |
| O | J | 3 feet | 3.40 | 19.48 | 67.70 | 9.42 | | 28 |
| N | K | 4' - 8" | 1.17 | 20,83 | 69.62 | 8.38 | Coking | 250 |
| I | Q | 9 feet | 0.87 | 21.43 | 68.07 | 9.63 | Coking | 286 |
| H | R | 7 feet | 1.01 | 21.54 | 68.51 | 8.94 | Coking | 100 |
| | | | | | | | | 1281 |

A(2) Mr. N. Elphinstone (1951) in his report on the area which we have designated, "Mt. Michael (East)", comments on the "abnormal thicknesses" of the coal there with the following notation:

| | |
|---|---|
| 11 feet | Shaly coal |
| 3 feet | Shale |
| 4 feet | Shaly coal |
| 2 feet | Shale |
| 10 feet | Shaly coal |
| 7 feet | Coal |

Analysis of the 7 foot coal seam gives an ash content of 7.1%.

A(3) This area was sampled again in 1978 and analysed by Loring Laboratories Ltd. of Calgary. These were oxidized outcrop samples and were analysed as composite samples. The 49 samples taken in the field were analysed as 17 composite samples. The samples were mixed on the basis of field notes on lithology, and variations in the nature of the coal sample.

CROWSNEST RESOURSES LTD.

Attn : J. Fisher

# LORING LABORATORIES LTD

## CERTIFICATE of COAL TESTING



| SAMPLE NO. | IDENTIFICATION | SAMPLE TYPE | | REC'D % $H_2O$ | % $H_2O$ | % VCL MATTER | % ASH | % FIXED CARBON | % S | BTU / LB. |
|---|---|---|---|---|---|---|---|---|---|---|
| # 1 | Comp F1–F2 | Raw Coal | Air Dried | – | 2.26 | 21.38 | 23.61 | 52.75 | .43 | 9974 |
| | | | Dry Basis | – | – | 21.87 | 24.16 | 53.97 | .44 | 10205 |
| # 2 | F3 | Raw Coal | Air Dried | – | 5.37 | 19.22 | 38.42 | 36.99 | .40 | 7093 |
| | | | Dry Basis | – | – | 20.31 | 40.60 | 39.09 | .42 | 7496 |
| # 3 | Comp F5–F13 | Raw Coal | Air Dried | – | 5.58 | 24.34 | 9.32 | 60.76 | .27 | 11178 |
| | | | Dry Basis | – | – | 25.78 | 9.87 | 64.35 | .29 | 11839 |
| # 4 | Comp F14 – F15 , F17 – F21 | Raw Coal | Air Dried | – | 5.12 | 24.31 | 16.06 | 54.51 | .24 | 10196 |
| | | | Dry Basis | – | – | 25.62 | 16.93 | 57.45 | .25 | 10746 |
| # 5 | F22 | Raw Coal | Air Dried | – | 10.00 | 22.34 | 26.93 | 40.73 | .19 | 7704 |
| | | | Dry Basis | – | – | 24.82 | 29.92 | 45.26 | .21 | 8560 |
| # 6 | F23 | Raw Coal | Air Dried | – | 5.21 | 17.93 | 48.03 | 28.83 | .14 | 5402 |
| | | | Dry Basis | – | – | 18.92 | 50.67 | 30.41 | .15 | 5699 |
| # 7 | F24 | Raw Coal | Air Dried | – | 6.66 | 24.65 | 9.21 | 59.48 | .22 | 10964 |
| | | | Dry Basis | – | – | 26.41 | 9.87 | 63.72 | .24 | 11746 |
| # 8 | Comp F25–F28 | Raw Coal | Air Dried | – | 6.14 | 25.96 | 8.18 | 59.72 | .19 | 11070 |
| | | | Dry Basis | – | – | 27.66 | 8.72 | 63.62 | .20 | 11794 |
| # 9 | F29 | Raw Coal | Air Dried | – | 6.86 | 22.97 | 22.73 | 47.44 | .21 | 8961 |
| | | | Dry Basis | – | – | 24.66 | 24.40 | 50.94 | .23 | 9621 |
| # 10 | Comp F30–F32 | Raw Coal | Air Dried | – | 5.50 | 25.42 | 11.64 | 57.44 | .28 | 10523 |
| | | | Dry Basis | – | – | 26.90 | 12.32 | 60.78 | .30 | 11135 |
| # 11 | F33 | Raw Coal | Air Dried | – | 10.85 | 24.42 | 17.66 | 47.07 | .22 | 8857 |
| | | | Dry Basis | – | – | 27.39 | 19.81 | 52.80 | .25 | 9935 |

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Attn : J. Fisher

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## CERTIFICATE of COAL TESTING



| SAMPLE NO. | IDENTIFICATION | SAMPLE TYPE | | REC'D % $H_2O$ | % $H_2O$ | % VCL MATTER | % ASH | % FIXED CARBON | % S | BTU /LB. |
|---|---|---|---|---|---|---|---|---|---|---|
| # 12 | Comp F34-F35 | Raw Coal | Air Dried | - | 5.19 | 25.76 | 8.05 | 61.00 | .22 | 11336 |
| | | | Dry Basis | - | - | 27.17 | 8.49 | 64.34 | .23 | 11957 |
| # 13 | F36 | Raw Coal | Air Dried | - | 12.04 | 25.28 | 10.82 | 51.86 | .20 | 9408 |
| | | | Dry Basis | - | - | 28.74 | 12.30 | 58.96 | .23 | 10696 |
| # 14 | Comp F37 - F38 | Raw Coal | Air Dried | - | 6.28 | 24.02 | 8.88 | 60.82 | .22 | 11194 |
| | | | Dry Basis | - | - | 25.63 | 9.48 | 64.89 | .23 | 11944 |
| # 15 | Comp F39 - F41 | Raw Coal | Air Dried | - | 5.19 | 24.82 | 10.61 | 59.38 | .25 | 10978 |
| | | | Dry Basis | - | - | 26.18 | 11.19 | 62.63 | .26 | 11579 |
| # 16 | Comp F42 - F43 | Raw Coal | Air Dried | - | 8.73 | 24.87 | 11.41 | 54.99 | .21 | 10287 |
| | | | Dry Basis | - | - | 27.25 | 12.50 | 60.25 | .23 | 11271 |
| # 17 | Comp F44 - F49 | Raw Coal | Air Dried | - | 10.83 | 24.42 | 19.12 | 45.63 | .23 | 8697 |
| | | | Dry Basis | - | - | 27.39 | 21.44 | 51.17 | .26 | 9753 |

A(4) Drill cuttings from the Ewin Pass program of 1970 gave the following data:

EWIN PASS BLOCK

| PROXIMATE RAW SAMPLE OF SEAM NO. | 10A | 10B | 9 | 8 | Marker Bed | 7 | 6 | Range | Average |
|---|---|---|---|---|---|---|---|---|---|
| ASH | 5.6-8.4 | 7.7-8.9 | 6.1-8.3 | 3.9-5.3 | 3.4-5.3 | 2.7-5.0 | 5.5-7.6 | 5.0-7.2 | 6.1 |
| MOISTURE | 0.3-0.8 | 0.6-1.0 | 0.7-1.8 | 0.8-1.2 | 0.6-1.1 | 0.8-1.9 | 0.9-2.2 | 0.7-1.4 | 1.1 |
| VOLATILE MATTER | 21.6-29.0 | 21.7-29.5 | 21.2-26.4 | 24.6-27.8 | 27.2-29.6 | 24.2-30.3 | 30.3-31.0 | 24.4-29.1 | 26.7 |
| FSI | 6 - 7 | 5 - 6.5 | 3 - 6 | 7 - 8 | 7 - 7.5 | 6 - 7 | 6.5-7.5 | 5.8-7.1 | 6.4 |

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K-SHELL NORTH CENTRAL BLOCK [illegible] A

(NOW, PRELIMINARILY CALLED "CS")

439

THE GOVERNMENT OF THE PROVINCE OF BRITISH COLUMBIA

DEPARTMENT OF MINES AND PETROLEUM RESOURCES

Coal Act (Sec. 19)

# APPLICATION TO EXTEND TERM OF LICENCE

1. I, GORDON A. SCHWARTZ (Name) agent for SHELL CANADA RESOURCES LIMITED (Name)
P.O. BOX 100 (Address) — P.O. BOX 100 (Address)
CALGARY, ALBERTA T2P 2H5 — CALGARY, ALBERTA T2P 2H5

Valid FMC No. 171 929

hereby apply to the Minister to extend the term of Coal Licences No(s). 295, 296, 298, 300, 301, 302, 303, 370; EIGHT LICENCES COVERING APPROXIMATELY 4,480 ACRES OR 1820 HA. for a further period of one year.

2. I have performed, or caused to be performed, during the period FEBRUARY 1, 1978 to JANUARY 30, 1979, work to the value of at least $ 139,853 on the location of coal licences as follows:

CATEGORY OF WORK

| | Licence No(s). | Apportioned Cost |
|---|---|---|
| Geological mapping | all eight licences above | $ 14,565 |
| Surveys: Geophysical | NONE | NIL |
| Geochemical | NONE | NIL |
| Other | all eight licences above | $ 23,278 |
| Road construction | 295, 296 | $ 10,829 |
| Surface work | NONE | NIL |
| Underground work | NONE | NIL |
| Drilling | 295, 296 | $ 60,955 |
| Logging, sampling, and testing | 295, 296 | $ 29,270 |
| Reclamation | 295, 296 | $ 956 |
| Other work (specify) | NONE | NIL |

3. I wish to apply $ 139,456 of this value of work on Coal Licence(s)* 295, 296, 298, 300, 301, 302, 303, 370; APPLICATION FILED CONCURRENTLY TO GROUP THESE EIGHT LICENCES INTO ONE NEW GROUP.

N.A. 4. I wish to pay cash in lieu of work in the amount of $_____ on Coal Licence(s) No(s)._____

N.A. 5. I wish to apply $_____ of this value of work to claim a refund of cash in lieu of work in the amount of $_____ which was paid to extend the term of Coal Licence(s) No(s)._____ from_____ to_____, 19____. Mining Receipt No._____ for prior payment of cash in lieu of work *is attached* for adjustment.

6. The work performed on the location(s) is detailed in the attached report entitled GEODETIC GROUND CONTROL SURVEY AND PHOTOGRAMMETRIC MAPPING – CENTRAL BLOCK, KOOTENAY LAND DISTRICT, B.C.; COAL PROJECT PROGRESS REPORT – HORSESHOE RIDGE, KOOTENAY LAND DISTRICT, B.C. – EXPLORATION AND GEOLOGICAL EVALUATION; BOTH OF THESE REPORTS ARE IN PREPARATION AND WILL BE SUBMITTED IN NINETY DAYS.

1979-01-31 (Date) — G. A. Schwartz (Signature and position) LANDMAN

* Applications to group licences may be filed to apportion costs on a maximum of 10 licences.

(FORMS TO BE SUBMITTED IN DUPLICATE)

FOR DEPARTMENTAL USE ONLY

Value of work reported $_____ Value of work applied on licences $_____

Value of work approved $_____ Value of credit remaining $_____

Work performed. Yes [x] No [ ]

The program of operations detailed hereunder was carried out during the period from FEBRUARY 1, 1978 to JANUARY 30, 19 79. Total costs are $ 139,853, an average of $ 31.22 per acre. or $ 77.14 PER HECTARE.

GEOLOGICAL MAPPING Yes [x] No [ ] Cost $ 14,565

| | Area (Acres) | Scale | Time |
|---|---|---|---|
| Reconnaissance | 4000 Ac = 1620 Ha | 1:5,000 | 70 MAN-DAYS |
| Detail: Surface | – | – | – |
| Underground | – | – | – |
| Other (specify) | – | – | – |

GEOPHYSICAL OR GEOCHEMICAL SURVEYS Yes [ ] No [x] Cost $ NIL

Method _____ Line miles _____

OTHER SURVEYS Yes [x] No [ ] Cost $ 23,278

Grid _____ Topographic PHOTOGRAMMETRIC Other GEODETIC GROUND CONTROL AND LOCATION MAPPING

ROAD CONSTRUCTION Yes [x] No [ ] Cost $ 10,829 UPGRADING & MAINTENANCE

Length: On Licences _____ Access (off licences) _____

SURFACE WORK Yes [ ] No [x] Cost $ NIL

| | Length | Licence Number(s) |
|---|---|---|
| Trenching | | |
| Seam tracing | | |
| Crosscutting | | |
| Other | | |

UNDERGROUND WORK Yes [ ] No [x] Cost $ NIL

Test adits: Number _____ Average length _____ Total footage _____

Other workings: Area _____ Total footage _____

DRILLING Yes [x] No [ ] Cost $ 60,955

| | Hole Size | Number of Holes | Total Footage |
|---|---|---|---|
| Core: Diamond [x] Wireline [ ] | HQ | 3 | 2032 feet = 614 m. |
| Rotary: Conventional [ ] | – | – | – |
| Reverse circulation [ ] | – | – | – |
| Other _____ | – | – | – |

Contractor TONTO DRILLING Where core stored CNRL LAB FERNIE, B.C.

LOGGING, SAMPLING, AND TESTING (check) Yes [x] No [ ] Cost $ 29,270

Lithology: Drill samples [ ] Core samples [x] Bulk samples [ ]

Logs: Gamma-Neutron [x] Density [x] Other [x]

Testing: Prox. analysis [x] FSI [x] Washability [x]

Carbonization [ ] Petrographic [ ] Plasticity [ ] Other [x]

OTHER WORK (specify details) NONE Cost $ NIL

REPORTS:

Reclamation work (Permit No. 54) Detail of work* SEEDING & FERTILIZING DRILL SITES AND SIDE ROADS, EROSION PREVENTION CROSS CUTS ON ROADS, DITCHING, REPORT WILL BE SUBMITTED BY MARCH 31'79 Cost $ 956

OPERATIONS:

Work was supervised by PAT GILMAR Position GEOLOGIST

Is this person a registered or licensed Professional Engineer in British Columbia? Yes [ ] No [x]

NOTE—Where the licensee intends to perform, during the extended term of his licence, work not set out in the plan of operations filed under section 15 (2) (c), a supplemental plan of operations is to be attached.

* If reclamation work reported in separate report give details of report identification.

VALUATION OF WORK: COST STATEMENT
(Sec. 27, B.C. Reg. 436/75)

ON-PROPERTY COSTS: For period from FEBRUARY 1, 1978 to JANUARY 30, 1979

1. OPERATOR'S FEES, SALARIES, AND WAGES:

| | Average Number of Employees | Average Rate | Average Number of Days | Amount |
|---|---|---|---|---|
| Professional and technical | 4 | $125/MAN DAY | 20 | $ 10,000 |
| Machine operators and support | | | | |
| Miners | | | | |
| Other | | | | |

Total operator's costs $ 10,000

2. CONTRACTORS AND CONSULTANTS:

| Name | Service | Contract Amount |
|---|---|---|
| SCRL SURVEY DEPT (INCLUDING SUBCONTRACTOR NORTHWEST SURVEY) | GEODETIC GROUND CONTROL SURVEY PHOTOGRAMMETRIC MAPPING | $ 21,028 |
| | GEODETIC LOCATION SURVEY | |
| TONTO DRILLING | DIAMON DRILLING | $ 47,819 |
| DRAIN BROTHERS CONSTRUCTION | BULLDOZER, BACKHOE WORK | $ 10,829 |
| GALLANT TRUCKING | WATER SUPPLY (TRUCK) | $ 1,780 |
| B&R DRILLING | DRILLING SUPERVISION | $ 3,000 |
| A.C.N. GEOL. CONSULTANTS | GEOL. CONSULTANT | $ 1,800 |

Total contractor and consultant costs $ 86,256

N.A. 3. EQUIPMENT AND INSTRUMENTS USED: Owned _____ Rented _____

| Type | Rented From | Amount |
|---|---|---|
| | | |
| | | |
| | | |
| | | |
| | | |

Total equipment and instrument rentals $ NIL

4. FIELD CAMP COSTS:

| | | Amount |
|---|---|---|
| Food | $16/MAN-DAY, 200 MAN-DAYS | $ 3,200 |
| Accommodation | $18/MAN-DAY, 200 MAN-DAYS | $ 3,600 |
| Fuel | | $ 3,000 |
| Other | MISCELLANEOUS (COMMUNICATION, POWER PLANT, TRAILER) | $ 1,800 |

Total field camp costs $ 11,600

5. SAMPLING, ANALYSIS, AND TESTING:

| Service | Performed by | Amount |
|---|---|---|
| WIRELINE LOGGING | BPB INDUSTRIES | $ 4,170 |
| ANALYSIS | CNI LAB | $ 2,380 |
| | | |
| | | |
| | | |

Totals, samplings, analysis, and testing $ 6,550

6. SUPPLIES AND MATERIALS COSTS:

| | Amount |
|---|---|
| Process supplies | |
| Operating and maintenance supplies | $ 1,776 |
| Office and technical supplies | $ 740 |
| Other supplies and materials | |

Total, supplies and materials $ 2,516

7. TRANSPORTATION COSTS (Ground transportation details):

| Vehicles | Owner | Rental Rate | Amount |
|---|---|---|---|
| two 4x4 trucks | WHEELAWAY | $1200/month * | $ 3,600 |
| one truck | KIKI TRUCKING | $25/hour 100 hours | $ 2,500 |
| | | | |

* including repairs

Air support details:

| Aircraft Type | Owner | Charter | |
|---|---|---|---|
| HELICOPTER 206B | KENTING | $375/hour 9hours | $ 3,375 |
| | | | |
| | | | |

Total transportation costs $ 9,475

8. RECLAMATION WORK:

INTERIOR REFORESTATION CO. LTD. $ 956

9. TRAVEL EXPENDITURES (operator's costs only):

| Number of Personnel | Number of Trips | Amount |
|---|---|---|
| EXPENDITURES IN ADDITION TO FIELD/CAMP COST ARE INCLUDED AS OVERHEAD IN THE $125 PER MAN-DAY ALLOCATION | | |

Total travel expenditures $ N.A.

Total costs $ 127,353

(Secs. 28 and 29, B.C. Reg. 436/75)

OFF-PROPERTY COSTS: Period from February 1, '78 to January 30, 1979

| | | Amount |
|---|---|---|
| (a) | Logistics and field support INCLUDED AS OVERHEAD IN $125/MAN-DAY | $ |
| (b) | Technical and feasibility studies | |
| (c) | Preparation of reports 100 MAN-DAYS, $125 PER MAN-DAY | 12,500 |
| (d) | Supplies and services INCLUDED AS OVERHEAD IN $125/MAN-DAY | |
| (e) | Mobilization and demobilization of equipment INCLUDED IN CONTRACT AMOUNTS | |
| (f) | Travelling expenses (Itemize) CALGARY - PROPERTY - CALGARY TRAVELLING IS INCLUDED AS OVERHEAD IN $125/MAN-DAY, NO OTHER TRAVELLING IS CONSIDERED. | |

Total $ 12,500

| Supporting Cost Statements Attached | Amount |
|---|---|
| ALL SUPPORTING COST IS INCLUDED IN $125/MAN-DAY | N.A. |

Total supporting costs $ N.A.

SUMMARY

On-property costs $ 127,353

Off-property costs $ 12,500

Total costs $ 139,853

Statement of costs verified by ACCOUNTING DIVISION, FINANCE & ADMINISTRATION, ECRL

1979-01-30
(Date)

(Signature and position)
ANALYST, ADMINISTRATION & PLANNING
CNRL

2M-473-8196

GROUP 29
(OLD)
REGROUPPED
CL 293
CL 292
CL 368
CL 294
CL 295
CL 373
CL 297
CL 296
CL 369
F R O N T
49°55'
CL 298
CL 299
GROUP
"CS"
(New)
CL 301
CL 300
GROUP 30
(OLD)
REGROUPPED
P R O V I N C I A L
CL 302
CL 303
CL 307
R A N G E S
CL 371
GROUP 31
MAINTAINED
O R E S T
R O C K Y
M O U N T A
CL 367
CL 312
CL 365

/ K-SHELL NORT CENTRE
BLOCK 70 A

GROUP "CB"
Appendix B
439

DEPARTMENT OF MINES AND PETROLEUM RESOURCES

Coal Act (Sec. 23)

# APPLICATION TO GROUP LICENCES

Licensee(s) SHELL CANADA RESOURCES LIMITED

Land district KOOTENAY

Location S.W. OF ELKFORD, B.C.

Date of application JANUARY 31, 1979

I/We, the undersigned licensee(s)* of the following coal licences, desire to group them according to the provisions of the *Coal Act:*

I/We, desire to consolidate the licences to obtain a uniform anniversary date: Yes [X] No [ ]

| Licence Number | HA. | AC. | Anniversary Date | Signature of Licensee |
|---|---|---|---|---|
| 277 | 260 | 640 | January 31 | |
| 278 | 260 | 640 | " | |
| 279 | 260 | 640 | " | |
| 280 | 260 | 640 | " | |
| 284 | 260 | 640 | " | |
| 285 | 260 | 640 | " | |
| 290 | 211 | 520 | " | [signature] ASSISTANT SECRETARY |
| 292 | 260 | 640 | " | |
| 297 | 260 | 640 | " | |
| 299 | 260 | 640 | " | |
| 304 | 82 | 202 | " | |
| 368 | 130 | 320 | " | |
| 369 | 260 | 640 | " | |
| 373 | 260 | 640 | " | |
| TOTAL 14 Licences | 3283 | 8082 | | |

* May be signed by a person authorized to sign on behalf of the licensee.

FOR DEPARTMENTAL USE ONLY

Approved uniform date All Licences were issued in 1975

Recording Fee: $5 for each licence in the group.

2M-675-8195

K SHELL NORTH CENTRAL BLOCK "A"

New, Preliminarily called "CB"

439

DEPARTMENT OF MINES AND PETROLEUM RESOURCES

Coal Act (Sec. 19)

# APPLICATION TO EXTEND TERM OF LICENCE

1. I, Gordon A. Schwartz (Name) agent for Shell Canada Resources Ltd. (Name)

P.O. Box 100 (Address)
Calgary, Alberta T2P2H5

P.O. Box 100 (Address)
Calgary, Alberta T2P 2H5

Valid FMC No. 171 929

hereby apply to the Minister to extend the term of Coal Licences No(s). 277, 278, 279, 280, 284, 285, 290, 292, 297, 299, 304, 368, 269, 373, 14 licences covering approximately 8420 acres = 3413 Hectares for a further period of one year.

2. I have performed, or caused to be performed, during the period February 1, 1978 to January 30, 19 79, work to the value of at least $ 294,973 on the location of coal licences as follows:

| CATEGORY OF WORK | Licence No(s). | Apportioned Cost |
|---|---|---|
| Geological mapping | all 14 licences above | $ 32,750 |
| Surveys: Geophysical | NONE | NIL |
| Geochemical | NONE | NIL |
| Other | all 14 licences above | $ 41,978 |
| Road construction | 297 upgrading & maintenence | $ 13,870 |
| Surface work | 277,278,279,280 | $ 4,140 |
| Underground work | NONE | NIL |
| Drilling | 297 | $ 94,490 |
| Logging, sampling, and testing | 297 | $ 46,645 |
| Reclamation | 297 | $ 900 |
| Other work (specify) | 297 | $ 60,200 |

3. I wish to apply $ 203,285 of this value of work on Coal Licence(s)* 277,278,279,280, 284,285,290,292,297,299,304,368,369,373; application filed concurrently to group these fourteen licences into one new group

N.A. 4. I wish to pay cash in lieu of work in the amount of $ _____ on Coal Licence(s) No(s). _____

N.A. 5. I wish to apply $ _____ of this value of work to claim a refund of cash in lieu of work in the amount of $ _____ which was paid to extend the term of Coal Licence(s) No(s). _____ from _____ to _____, 19____. Mining Receipt No. _____ for prior payment of cash in lieu of work *is attached* for adjustment.

6. The work performed on the location(s) is detailed in the attached report entitled Geodetic Ground Control Survey and Photogrammetric Mapping-Central Block, Kootenay Land District, B.C.; Coal ~~Project final report-Line Cr. Ridge, Kootenay Land District, B.C.-Exploration and~~ Geological evaluation; coal project progress report-North Central Block, Kootenay Land District, B.C.-Exploration and Geological Evaluation; all these three reports are in preparation and will be submitted in 90 days.

(Date) 1979---01---30

G. A. Schwartz
(Signature and position)
Landman - SCRL

* Applications to group licences may be filed to apportion costs on a maximum of 10 licences.

(FORMS TO BE SUBMITTED IN DUPLICATE)

---

FOR DEPARTMENTAL USE ONLY

Value of work reported $ _____ Value of work applied on licences $ _____

Value of work approved $ _____ Value of credit remaining $ _____

Work performed. Yes [X] No [ ]

The program of operations detailed hereunder was carried out during the period from February 1, 1978 to January 30, 19 79. Total costs are $ 294,973, an average of $ 35.03 per acre. or $86.56 per hectar

GEOLOGICAL MAPPING Yes [X] No [ ] Cost $ 32,750

| | Area (Acres) | Scale | Time |
|---|---|---|---|
| Reconnaissance | 9000Ac = 3642 Ha<br>640Ac = 259 Ha | 1: 16,000<br>1: 15,000 | 25 man-days<br>30 man-days |
| Detail: Surface | 2560Ac = 1036 Ha<br>5Ac = 2 Ha | 1: 16,000<br>1: 5,000 | 80 man-days<br>14 man-days |
| Underground | NIL | NIL | |
| Other (specify) | measuring stratigraphic sections 610 m | 1: 500 | 35 man-days |

GEOPHYSICAL OR GEOCHEMICAL SURVEYS Yes [ ] No [X] Cost $ NIL

Method _____ Line miles _____

OTHER SURVEYS Yes [X] No [ ] Cost $ 41,978

Grid _____ Topographic Geodetic Ground Control and Location Survey Photogrammetric Mapping

ROAD CONSTRUCTION Yes [X] No [ ] Cost $ 13,870

Length: On Licences 10 kilometres Access (off licences) 3 kilometres Upgrading and Maintenance Only

SURFACE WORK Yes [X] No [ ] Cost $ 4,140

| | Length | Licence Number(s) |
|---|---|---|
| Trenching | 10 m | 277 |
| Seam tracing | 2000 m | 278, 279, 280 |
| Crosscutting | | |
| Other | | |

UNDERGROUND WORK Yes [ ] No [X] Cost $ NIL

Test adits: Number _____ Average length _____ Total footage _____

Other workings: Area _____ Total footage _____

DRILLING Yes [X] No [ ] Cost $ 94,490

| | Hole Size | Number of Holes | Total Footage |
|---|---|---|---|
| Core: Diamond [X] Wireline [ ] | HQ | 4 | 2,936 ft=895m |
| Rotary: Conventional [ ] | | | |
| Reverse circulation [ ] | | | |
| Other | | | |

Contractor Tonto Drilling Where core stored CNRL Lab Fernie, B.C.

LOGGING, SAMPLING, AND TESTING (check) Yes [X] No [ ] Cost $ 46,645

Lithology: Drill samples [ ] Core samples [X] Bulk samples [ ]

Logs: Gamma-Neutron [X] Density [X] Other [X]

Testing: Prox. analysis [X] FSI [X] Washability [X]

Carbonization [ ] Petrographic [ ] Plasticity [ ] Other [ ]

OTHER WORK (specify details) Geotechnical Installations, Tests, Survey Cost $ 60,200

REPORTS:

Reclamation work (Permit No. 54 ) Detail of work* Seeding and Fertilizing Drill Sites, side roads, erosion control trenching

Report will be submitted by March 31, 1979 Cost $ 900

OPERATIONS:

Work was supervised by Ted Hannah Position Geologist

Is this person a registered or licensed Professional Engineer in British Columbia? Yes [ ] No [X]

NOTE—Where the licensee intends to perform, during the extended term of his licence, work not set out in the plan of operations filed under section 15 (2) (c), a supplemental plan of operations is to be attached.

* If reclamation work reported in separate report give details of report identification.

VALUATION OF WORK: COST STATEMENT
(Sec. 27, B.C. Reg. 436/75)

ON-PROPERTY COSTS: For period from February 1, 1978 to January 30, 1979

1. OPERATOR'S FEES, SALARIES, AND WAGES:

| | Average Number of Employees | Average Rate | Average Number of Days | Amount |
|---|---|---|---|---|
| Professional and technical | 5 | $125 / man-day | 53 | 33,125 |
| Machine operators and support | NIL | | | |
| Miners | NONE | | | |
| Other | NIL | | | |

Total operator's costs $

2. CONTRACTORS AND CONSULTANTS:

| Name | Service | Contract Amount |
|---|---|---|
| SCRL - Survey Dept. | Geodetic Ground Control Survey | $ 38,578 |
| (including subcontractor | Photogrammetric Mapping | |
| Northwest Survey) | Geodetic Location Survey | |
| Tonto Drilling | Diamond Drilling | $ 64,300 |
| Drain Brothers Construction | Earth Moving (bulldozer etc) | $ 11,420 |
| Ackles Trucking | Water Supply (truck) | $ 11,450 |
| Gallant Trucking | Water Supply (truck) | $ 2,100 |
| A.C.M. Geol. Consultants | Geol Consultant | $ 3,900 |
| B&R Drilling | Drilling Supervison | $ 1,450 |
| Jamieson Geol. Consultants | Bulldozer Supervison | $ 630 |
| | (TOTAL CONTRACTOR & CONSULTANT COSTS | $133,828 |

N.A. 3 EQUIPMENT AND INSTRUMENTS USED:

| | Owned | |
|---|---|---|
| | Rented | Amount |
| | | NIL |
| | | |

Total equipment and instrument rentals $ NIL

4. FIELD CAMP COSTS:

| | | Amount |
|---|---|---|
| Food | 536 man-days, $16 per man-day | $ 8,572 |
| Accommodation | 536 man-days, $18 per man-day | 9,648 |
| Fuel | | 2,060 |
| Other | Miscellaneous (Communication, Power Plan, Trailer) | 2,400 |

Total field camp costs $ 22,680

5. SAMPLING, ANALYSIS, AND TESTING:

| Service | Performed by | Amount |
|---|---|---|
| Wireline Logging | BPB Industries | $ 8,600 |
| Geotechnical tests | Golder Associates | 60,200 |
| Analysis | CNI Lab | 2,940 |

Totals, samplings, analysis, and testing $ 71,740

6. SUPPLIES AND MATERIALS COSTS:

| | Amount |
|---|---|
| Process supplies | |
| Operating and maintenance supplies | 6,100 |
| Office and technical supplies | 2,350 |
| Other supplies and materials | |

Total, supplies and materials $ 8,450

7. TRANSPORTATION COSTS (Ground transportation details):

| Vehicles | Owner | Rental Rate | Amount |
|---|---|---|---|
| four 4x4 trucks | Minchuk Leasing | * $ 1,200/month | $ 4,800 |
| three trucks | Kiki Trucking | $25/hour, 92 hours | $ 2,300 |

* including repairs

Air support details:

| Aircraft Type | Owner | Charter | |
|---|---|---|---|
| Helicopter 206 B | Kenting | $375/hour 14.7 hours | $ 5,275 |
| | | | |
| | | | |

Total transportation costs $ 12,375

8. RECLAMATION WORK:

Interior Reforestation Co. Ltd. $ 900

9. TRAVEL EXPENDITURES (operator's costs only):

| Number of Personnel | Number of Trips | Amount |
|---|---|---|
| Expenditures in addition to field/camp cost are included as overhead in the $125 per man-day allocation | | |

Total travel expenditures $ N.A.

Total costs $ 283,098

(Secs. 28 and 29, B.C. Reg. 436/75)

OFF-PROPERTY COSTS: Period from February 1, 1978 to January 30, 1979

| | | Amount |
|---|---|---|
| (a) Logistics and field support | included as overhead in $125 per man day | $ |
| (b) Technical and feasibility studies | | NIL |
| (c) Preparation of reports | 95 man-days, $125 per man day | $ 11,875 |
| (d) Supplies and services | included as overhead in $125 per man-day | N.A. |
| (e) Mobilization and demobilization of equipment | included in contract amounts | N.A. |
| (f) Travelling expenses (Itemize) | | N.A. |

Calgary-Property - Calgary travelling is included as overhead in the $125 per man-day, no other travelling has been considered

Total $ 11,875

Supporting Cost Statements Attached

| | Amount |
|---|---|
| all supporting cost is included in the $125 per man-day | N.A. |
| | |
| | |
| | |
| | |
| | |
| | |
| | |

Total supporting costs $ N.A.

SUMMARY

On-property costs $ 283,098

Off-property costs $ 11,875

Total costs $ 294,973

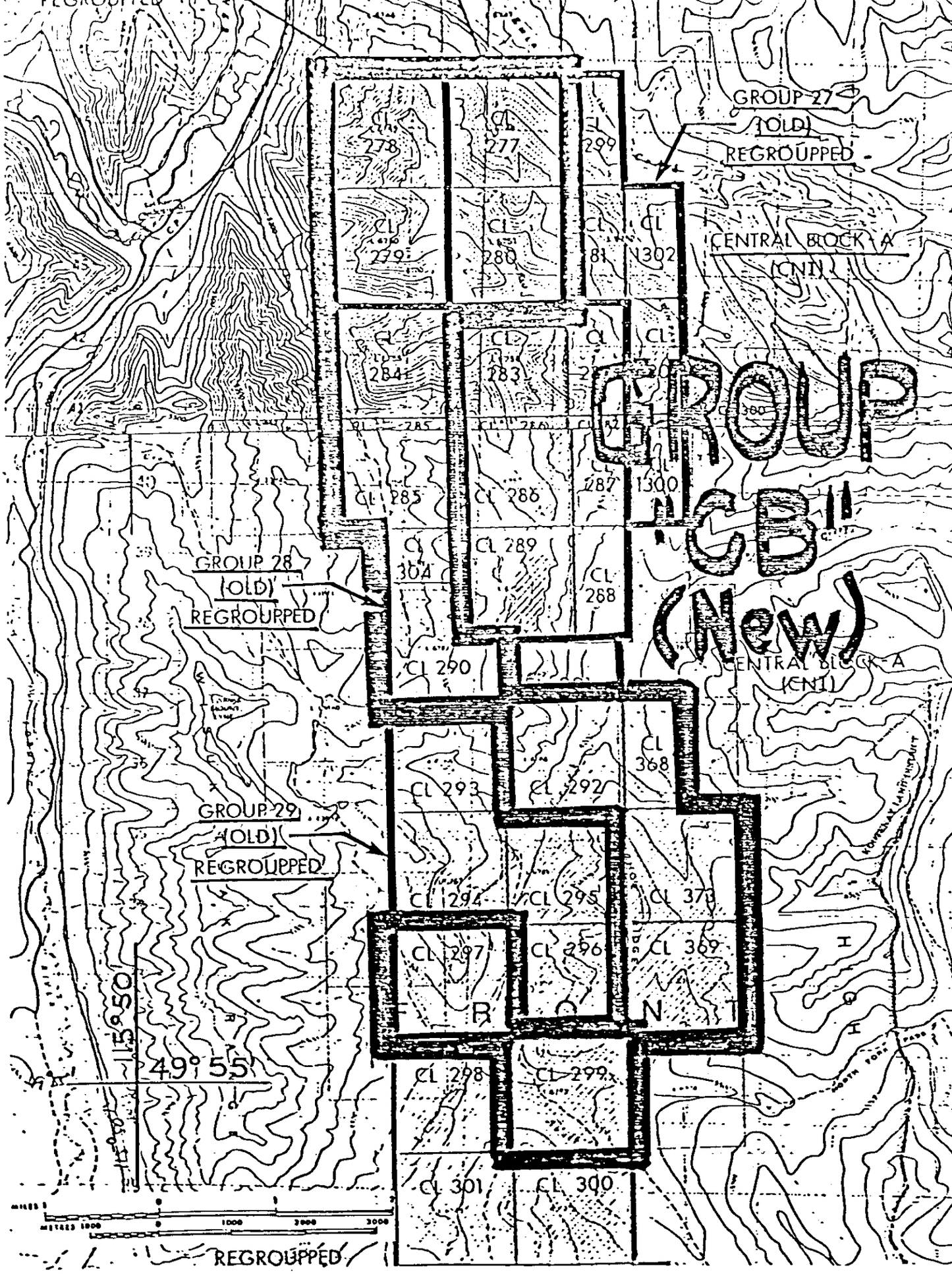
Statement of costs verified by Accounting Division, Finance & Administration, SCRL

1979 - 01 - 30 (Date)

(Signature and position)

Analyst, Administration and Planning
CNRL

3M-675-8196


GROUP 27
(OLD)
REGROUPPED
CENTRAL BLOCK A
(CNI)
GROUP "CB" (New)
GROUP 28
(OLD)
REGROUPPED
GROUP 29
(OLD)
REGROUPPED
CL 278
CL 277
CL 299
CL 279
CL 280
CL 281
CL 1302
CL 284
CL 283
CL 285
CL 286
CL 287
CL 1300
CL 304
CL 289
CL 288
CL 290
CL 293
CL 292
CL 368
CL 294
CL 295
CL 373
CL 297
CL 296
CL 369
CL 298
CL 299
CL 301
CL 300
115°50'
49°55'
REGROUPPED

GROUP "CA"

Appendix B

DEPARTMENT OF MINES AND PETROLEUM RESOURCES

Coal Act (Sec. 23)

# APPLICATION TO GROUP LICENCES

Licensee(s) SHELL CANADA RESOURCES LIMITED

Land district KOOTENAY

Location S.W. ELKFORD, B.C.

Date of application JANUARY 31, 1979

I/We, the undersigned licensee(s)* of the following coal licences, desire to group them according to the provisions of the *Coal Act:*

I/We, desire to consolidate the licences to obtain a uniform anniversary date: Yes [X] No [ ]

| Licence Number | HA. | AC. | Anniversary Date | Signature of Licensee |
|---|---|---|---|---|
| 281 | 130 | 320 | January 31 | |
| 282 | 130 | 320 | " | |
| 283 | 260 | 640 | " | |
| 286 | 260 | 640 | " | |
| 287 | 130 | 320 | " | |
| 288 | 130 | 320 | " | |
| 289 | 260 | 640 | " | |
| 291 | 133 | 328 | " | |
| 293 | 260 | 640 | " | |
| 294 | 260 | 640 | " | |
| 1299 | 130 | 320 | " | |
| 1300 | 130 | 320 | " | |
| 1301 | 130 | 320 | " | |
| 1302 | 130 | 320 | " | |
| TOTAL 14 Lics | 2473 | 6088 | | |

ASSISTANT SECRETARY

* May be signed by a person authorized to sign on behalf of the licensee.

FOR DEPARTMENTAL USE ONLY

All Licences were issued in 1975

Approved uniform date _____

Recording Fee: $5 for each licence in the group.

2M-675-8195

K-SHELL NORTH CENTRAL
BURNTIVA

(New, PRELIMINARILY CALLED "CA")

439

THE GOVERNMENT OF THE PROVINCE OF BRITISH COLUMBIA

DEPARTMENT OF MINES AND PETROLEUM RESOURCES

Coal Act (Sec. 19)

# APPLICATION TO EXTEND TERM OF LICENCE

1. I, Gordon A. Schwartz (Name) agent for Shell Canada Resources Limited (Name)

P. O. Box 100 (Address) — P. O. Box 100 (Address)

Calgary, Alberta T2P 2H5 — Calgary, Alberta T2P 2H5

Valid FMC No. 171 929

hereby apply to the Minister to extend the term of Coal Licences No(s). 281,282,283,286,287,288,289, 291,293,294,1299,1300,1301,1302; 14 licences covering approximately 6088 acres = 2473 hectares for a further period of one year.

2. I have performed, or caused to be performed, during the period February 1, 1978 to January 30, 19 79, work to the value of at least $ $771,417 on the location of coal licences as follows:

CATEGORY OF WORK

| | Licence No(s). | Apportioned Cost |
|---|---|---|
| Geological mapping | all 14 licences above | $ 65,530 |
| Surveys: Geophysical | None | NIL |
| Geochemical | None | NIL |
| Other - Geodetic | all 14 licences above | $ 56,691 |
| Road construction | 294 | $ 44,540 |
| Surface work | 281,282,287,288,289,290 1299,1300,1301,1302 | $ 13,970 |
| Underground work | ~~None~~ | ~~NIL~~ |
| Drilling | 294 | $348,912 |
| Logging, sampling, and testing | 294 | $180,355 |
| Reclamation | 294 | $ 919 |
| Other work (specify) Geotechnical | 294 | $ 60,500 |

3. I wish to apply $ 165,826 of this value of work on Coal Licence(s)* 281,282,283,286, 287,288,289,291,293,294,1299,1300,1301,1302; application filed concurrently to group these fourteen licences into one group.

N.A. 4. I wish to pay cash in lieu of work in the amount of $ _____ on Coal Licence(s) No(s). _____

N.A. 5. I wish to apply $ _____ of this value of work to claim a refund of cash in lieu of work in the amount of $ _____ which was paid to extend the term of Coal Licence(s) No(s). _____ from _____ to _____, 19____. Mining Receipt No. _____ for prior payment of cash in lieu of work *is attached* for adjustment.

6. The work performed on the location(s) is detailed in the attached report entitled Geodetic Ground Control Survey and Photogrammetric Mapping - Central Block, Kootenay Land District, B.C.; Coal Project Final report - Line Cr. Ridge, Kootenay Land District, B.C. - Exploration and Geological Evaluation; coal progress report - North Central Block, Kootenay Land District, B.C. - Exploration and Geological Evaluation; All three reports are in progress and will be submitted within 90 days.

1979-01-31 (Date) — G. A. Schwartz (Signature and position) LANDMAN

* Applications to group licences may be filed to apportion costs on a maximum of 10 licences.

(FORMS TO BE SUBMITTED IN DUPLICATE)

FOR DEPARTMENTAL USE ONLY

Value of work reported $ _____ Value of work applied on licences $ _____

Value of work approved $ _____ Value of credit remaining $ _____

Work performed. Yes [X] No [ ]

The program of operations detailed hereunder was carried out during the period from February 1, 1978 to January 30, 19 79. Total costs are $ 771,417, an average of $ 126.71 per acre. or $313.10 per hectar

GEOLOGICAL MAPPING Yes [X] No [ ] Cost $ 65,530

| | Area (Acres) | Scale | Time |
|---|---|---|---|
| Reconnaissance | 6482 Ac = 2623 Ha | 1:16,000 | 240 man-days |
| Detail: Surface | 640 Ac = 259 Ha | 1: 2,000 | 80 man-days |
| Underground | NIL | | |
| Other (specify) | measuring stratigraphic sections 2998 m. | 1: 500 | 48 man-days |

GEOPHYSICAL OR GEOCHEMICAL SURVEYS Yes [ ] No [X] Cost $ NIL

Method _____ Line miles _____

OTHER SURVEYS Yes [X] No [ ] Cost $ 56,691

Grid _____ Topographic Geodectic ground control and location ~~survey photogrammetric mapping~~

ROAD CONSTRUCTION Yes [X] No [ ] Cost $ 44,540

Length: On Licences 19.2 kilometres Access (off licences) 12.8 kilometres upgrading & maintenance

SURFACE WORK Yes [X] No [ ] Cost $ 13,970

| | Length | Licence Number(s) |
|---|---|---|
| Trenching | by hand 505 m. | 282,287,288,289 |
| Seam tracing | by hand 6000 m. | 282, 287, 288, 290 |
| Crosscutting | - | |
| Other | by hand tracing marker bed 5000 m. | 281, 1299, 1300, 1301, 1302 |

UNDERGROUND WORK Yes [ ] No [X] Cost $ NIL

Test adits: Number _____ Average length _____ Total footage _____

Other workings: Area _____ Total footage _____

DRILLING Yes [X] No [ ] Cost $ 348,912

| | Hole Size | Number of Holes | Total Footage |
|---|---|---|---|
| Core: Diamond [X] Wireline [ ] | HQ | 11 | 10,505 ft.=3,183 m. |
| Rotary: Conventional [ ] | | | |
| Reverse circulation [ ] | | | |
| Other | | | |

Contractor Tonto Drilling Where core stored CNRL Lab, Fernie, B.C.

LOGGING, SAMPLING, AND TESTING (check) Yes [X] No [ ] Cost $ 180,355

Lithology: Drill samples [ ] Core samples [X] Bulk samples [ ]

Logs: Gamma-Neutron [X] Density [X] Other [X]

Testing: Prox. analysis [X] FSI [X] Washability [X]

Carbonization [ ] Petrographic [ ] Plasticity [ ] Other [ ]

OTHER WORK (specify details) Geotechnical installations, tests, survey Cost $ 60,500

REPORTS:

Reclamation work (Permit No. 54 ) Detail of work* Seeding and fertilizing drill sites and side roads

Report will be submitted by March 31, 1979 Cost $ 919

OPERATIONS:

Work was supervised by Ted Hannah Position Geologist

Is this person a registered or licensed Professional Engineer in British Columbia? Yes [ ] No [X]

NOTE—Where the licensee intends to perform, during the extended term of his licence, work not set out in the plan of operations filed under section 15 (2) (*c*), a supplemental plan of operations is to be attached.

* If reclamation work reported in separate report give details of report identification.

VALUATION OF WORK: COST STATEMENT
(Sec. 27, B.C. Reg. 436/75)

ON-PROPERTY COSTS: For period from February 1, 1978 to January 30, 1979

1. OPERATOR'S FEES, SALARIES, AND WAGES:

| | Average Number of Employees | Average Rate | Average Number of Days | Amount |
|---|---|---|---|---|
| Professional and technical | 5 | $125/man-day | 149 | $ 93,125 |
| Machine operators and support | NIL | | | |
| Miners | NONE | | | |
| Other | NIL | | | |

Total operator's costs $ 93,125

2. CONTRACTORS AND CONSULTANTS:

| Name | Service | Contract Amount |
|---|---|---|
| SCRL - Survey Dept. | Geodetic ground control survey | $ 46,716 |
| (including Subcontractor | Photogrammetric mapping | |
| ~~Northwest Survey)~~ | ~~Geodetic location survey~~ | |
| Tonto Drilling | Diamond Drilling | $238,500 |
| Drain Brothers Construction | Bulldozer etc. work | $ 41,200 |
| ~~Ackles Trucking~~ | ~~Water Supply (truck)~~ | ~~$ 48,600~~ |
| ANC Geol. Consultants | Geol. Consultant | $ 13,900 |
| B&R Drilling | Drilling Supervisor | $ 4,500 |
| Jamieson Geol. Consultants | Bulldozer Supervisor | ~~$ 2,000~~ |

TOTAL CONTRACTOR AND CONSULTANT COSTS $395,416

.A. 3. EQUIPMENT AND INSTRUMENTS USED:

| | | Amount |
|---|---|---|
| | Owned: | |
| | Rented: | |

Total equipment and instrument rentals $ NIL

4. FIELD CAMP COSTS:

| | | Amount |
|---|---|---|
| Food | 1322 man-days; $16 per man-day | $ 21,152 |
| Accommodation | 1320 man-days; $18 per man-day | $ 23,760 |
| Fuel | | $ 6,350 |
| Other | Miscellaneous(Communication,Power Plant,Trailer,etc) | $ 7,250 |

Total field camp costs $ 58,512

5. SAMPLING, ANALYSIS, AND TESTING:

| Service | Performed by | Amount |
|---|---|---|
| Wireline Logging | BPB Industries | $ 30,900 |
| Geotechnical installations,tests | Golder Associates | $ 60,500 |
| Analyses | CNI Lab | $ 15,470 |

Totals, samplings, analysis, and testing $ 106,870

6. SUPPLIES AND MATERIALS COSTS:

| | Amount |
|---|---|
| Process supplies | |
| Operating and maintenance supplies | 22,100 |
| Office and technical supplies | 7,900 |
| Other supplies and materials | |

Total, supplies and materials $ 30,000

7. TRANSPORTATION COSTS (Ground transportation details):

| Vehicles | Owner | Rental Rate | Amount |
|---|---|---|---|
| four 4x4 truck | Minchuk leasing | $1200/month* | $ 14,600 |
| three trucks | Kiki Trucking | $25/hour,330 hours | $ 8,250 |

* Including repairs

Air support details:

| Aircraft Type | Owner | Charter |
|---|---|---|
| Helicoptor 206 B | Kenting | $375/hour 42.5 hours $17,475 |
| | | |
| | | |

Total transportation costs $ 40,325

8. RECLAMATION WORK:

Interior Reforestation Co. Ltd. $ 919

9. TRAVEL EXPENDITURES (operator's costs only):

| Number of Personnel | Number of Trips | Amount |
|---|---|---|
| expenditures in addition to field/camp cost are included as overhead in the $125 per man-day allocation | | |

Total travel expenditures $ N.A.

Total costs $ 725,167

(Secs. 28 and 29, B.C. Reg. 436/75)

OFF-PROPERTY COSTS: Period from _____ to _____, 19____

| | Amount |
|---|---|
| (a) Logistics and field support | $ |
| (b) Technical and feasibility studies | |
| (c) Preparation of reports 370 man-days; $125 per man-day | 46,250 |
| (d) Supplies and services | |
| (e) Mobilization and demobilization of equipment | |
| (f) Travelling expenses (Itemize) | |

Total $ 46,250

Supporting Cost Statements Attached

| Amount |
|---|
| |

Total supporting costs $ _____

SUMMARY

| | |
|---|---|
| On-property costs | $ 725,167 |
| Off-property costs | $ 46,250 |
| Total costs | $ 771,417 |

Statement of costs verified by Accounting Devision, Finance & Administration, SCRL

1979-01-30
(Date)

(Signature and position)
Analyst, Administration & Planning
CNRL

EM-673-8196

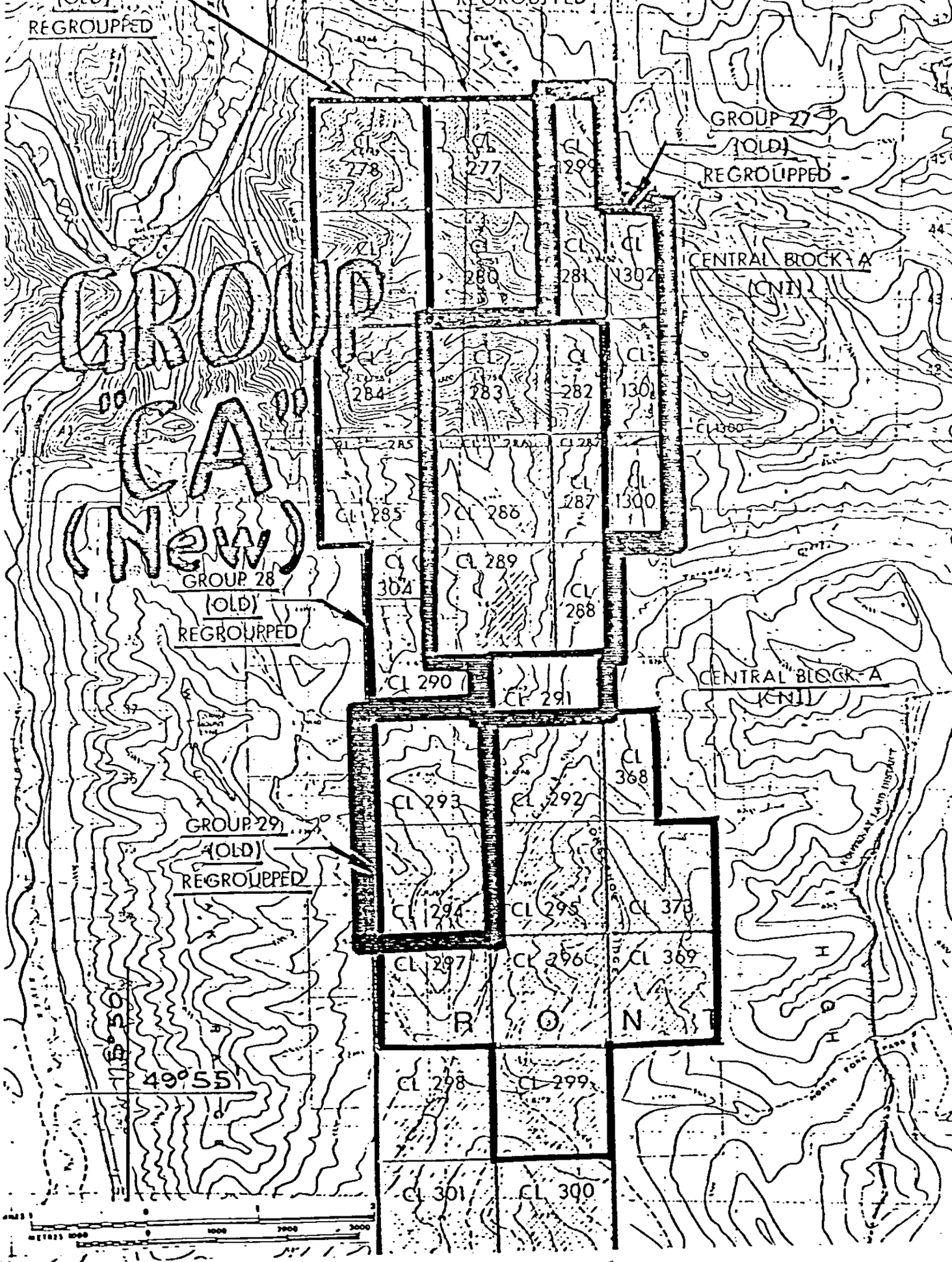

REGROUPPED
GROUP 27
(OLD)
REGROUPPED
CENTRAL BLOCK A
(CNI)
GROUP "A"
(New)
GROUP 28
(OLD)
REGROUPPED
CENTRAL BLOCK A
(CNI)
GROUP 29
(OLD)
REGROUPPED
49°55
CL 278
CL 277
CL 299
CL 280
CL 281
CL 1302
CL 284
CL 283
CL 282
CL 1301
CL 285
CL 286
CL 287
CL 1300
CL 304
CL 289
CL 288
CL 290
CL 291
CL 293
CL 292
CL 368
CL 294
CL 295
CL 373
CL 297
CL 296
CL 369
R O N
CL 298
CL 299
CL 301
CL 300

Fig 12

K-SHELL NORTH CENTRAL
BLOCK 78(?)A

GROUP "CS"

Appendix B

439

DEPARTMENT OF MINES AND PETROLEUM RESOURCES

Coal Act (Sec. 23)

# APPLICATION TO GROUP LICENCES

Licensee(s) SHELL CANADA RESOURCES LIMITED

Land district KOOTENAY

Location S.W. OF ELKFORD, B.C.

Date of application JANUARY 31, 1979

I/We, the undersigned licensee(s)* of the following coal licences, desire to group them according to the provisions of the *Coal Act:*

I/We, desire to consolidate the licences to obtain a uniform anniversary date: Yes [X] No [ ]

| Licence Number | HA. | AC. | Anniversary Date | Signature of Licensee |
|---|---|---|---|---|
| 295 | 260 | 640 | January 31 | |
| 296 | 260 | 640 | " | |
| 298 | 260 | 640 | " | |
| 300 | 260 | 640 | " | [signature] |
| 301 | 260 | 640 | " | ASSISTANT SECRETARY |
| 302 | 260 | 640 | " | |
| 303 | 130 | 320 | " | |
| 370 | 130 | 320 | " | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| AL 8 Licences | 1820 | 4480 | | |

* May be signed by a person authorized to sign on behalf of the licensee.

FOR DEPARTMENTAL USE ONLY All Licences were issued in 1975

Approved uniform date

Recording Fee: $5 for each licence in the group.

2M-675-8195

# CROWS NEST RESOURCES LIMITED
# EXPLORATION 439

## COAL PROPERTY REVIEW
## COAL QUALITY SUMMARY WORK SHEET - GENERAL

PROVINCE :  REGION :

MORE INFORMATION AVAILABLE:
- ☐ REVIEW PART ONE: SUMMARIES
- ☐ SUMMARY SHEET (S)
- ☐ REVIEW PART TWO: FULL LENGTH REPORTS
- ☐ COAL PROPERTY INFORMATION WORK SHEET – GENERAL
- ☐ COAL QUALITY SUMMARY WORK SHEET – GENERAL
- ☐ COAL QUALITY SUMMARY WORK SHEET – METALURGICAL PROPERTIES
- ☐ B.C. COAL LICENCES TENURE STANDING
- ☐

DATE/BY :

| | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| BLOCK : | | | | CENTRAL | | | | | | | | | | | | | | | | |
| PROJECT : | | | | MT. MICHAEL EAST | | | | | | | | | | | | | | | | |
| USES : | | | | | | | | | | | | | | | | | | | | |
| RANK : | ASTM INTERNATIONAL | | | | | | | | | | | | | | | | | | | |
| SOURCE : | SEAM, ETC. FAULT THICKENED SEAMS | | | | | | | | | | | | | | | | | | | |
| | PROPORTION | | weight % | | | | | | | | | | | | | | | | | |
| THICKNESS : | GROSS | | m | | | | | | | | | | | | | | | | | |
| | NET | | 44.9 m | | | | | | | | | | | | | | | | | |
| | SAMPLE | | m | 1.35 | 0.75 | 8.4 | 5.6 | 0.9 | 1.0 | 1.0 | 3.2 | 0.8 | 2.4 | 0.8 | 1.6 | 0.8 | 1.6 | 1.9 | 1.7 | 11.1 |
| RAW | CLEAN | BASIS | **ANALYSES, TESTS** | | | | | | | | | | | | | | | | | |
| | | | **PROXIMATE** | | | | | | | | | | | | | | | | | |
| • | | | SAMPLE TYPE | | | | | | | | | | | | | | | | | |
| | | | ASH | % | | | | | | | | | | | | | | | | |
| | | | MOISTURE | % | 2.26 | 5.37 | 5.58 | 5.12 | 10.00 | 5.21 | 6.66 | 6.14 | 6.86 | 5.5 | 10.85 | 5.19 | 12.04 | 6.28 | 5.19 | 8.73 | 10.83 |
| | | | HEAT VALUE | MJ/Kg,Kcal/Kg,Btu/lb | | | | | | | | | | | | | | | | | |
| • | | | **PROXIMATE** | | | | | | | | | | | | | | | | | |
| | | | COMPOSITE SAMPLE No. | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 |
| | | | SAMPLE TYPE | | | | | | | | | | | | | | | | | | |
| | | | FLOAT SG | | | | | | | | | | | | | | | | | | |
| | | | YIELD | % | | | | | | | | | | | | | | | | | |
| | | | ASH | % | 24.16 | 40.60 | 9.87 | 16.93 | 29.92 | 50.67 | 9.87 | 8.72 | 24.40 | 12.32 | 19.81 | 8.49 | 12.30 | 9.48 | 11.19 | 12.50 | 21.44 |
| | | | MOISTURE (DRIED) | % | | | | | | | | | | | | | | | | | |
| | | | VOLATILE MATTER | % | 21.87 | 20.31 | 25.78 | 25.62 | 24.82 | 18.92 | 26.41 | 27.66 | 24.66 | 26.90 | 27.39 | 27.17 | 28.74 | 25.63 | 26.18 | 27.25 | 27.39 |
| | | | FIXED CARBON | % | 53.97 | 39.09 | 64.35 | 57.45 | 45.26 | 30.41 | 63.72 | 63.62 | 50.94 | 60.78 | 52.80 | 64.34 | 58.96 | 64.89 | 62.63 | 60.25 | 51.17 |
| | | | HEAT VALUE | Btu/lb | 10205 | 7496 | 11839 | 10746 | 8560 | 5699 | 11746 | 11794 | 9621 | 11135 | 9935 | 11957 | 10696 | 11944 | 11579 | 11271 | 9753 |
| | | | **ULTIMATE** | | | | | | | | | | | | | | | | | | |
| | | | SAMPLE TYPE | | | | | | | | | | | | | | | | | | |
| | | | C | % | | | | | | | | | | | | | | | | | |
| | | | H | % | | | | | | | | | | | | | | | | | |
| | | | O | % | | | | | | | | | | | | | | | | | |
| | | | N TOTAL | % | | | | | | | | | | | | | | | | | |
| | | | ORGANIC | % | | | | | | | | | | | | | | | | | |
| | | | S TOTAL | % | | | | | | | | | | | | | | | | | |
| | | | ORGANIC | % | | | | | | | | | | | | | | | | | |
| | | | SULPHIDE | % | | | | | | | | | | | | | | | | | |
| | | | SULPHATE | % | | | | | | | | | | | | | | | | | |
| | | | P TOTAL | % | | | | | | | | | | | | | | | | | |
| | | | **ASH** | | | | | | | | | | | | | | | | | | |
| | | | SAMPLE TYPE | | | | | | | | | | | | | | | | | | |
| | | | FUSION TEMP. INITIAL | °C | | | | | | | | | | | | | | | | | |
| | | | RESISTIVITY | Ohm-metre | | | | | | | | | | | | | | | | | |
| | | | GRINDIBILITY (HARDGROVE) | 1 | | | | | | | | | | | | | | | | | |
| | | | SIZE | mm/in | | | | | | | | | | | | | | | | | |
| | | | SCREEN ANALYSIS SIZE | mm/in | | | | | | | | | | | | | | | | | |
| | | | PROPORTIONS | % | | | | | | | | | | | | | | | | | |
| | | | **WASHABILITY TESTS** | | | | | | | | | | | | | | | | | | |
| | | | **PETROGRAPHY** | | | | | | | | | | | | | | | | | | |
| | | | REACTIVES | % | | | | | | | | | | | | | | | | | |
| | | | INERTS | % | | | | | | | | | | | | | | | | | |
| | | | MEAN REFLECTANCE ($R_o$) | 1 | | | | | | | | | | | | | | | | | |
| | | | COKE STRENGTH PREDICTED | INDEX | | | | | | | | | | | | | | | | | |
| | | | COKE STABILITY PREDICTED | INDEX | | | | | | | | | | | | | | | | | |
| | | | **CAKING** | | | | | | | | | | | | | | | | | | |
| | | | FSI (ASH %) | INDEX (%) | | | | | | | | | | | | | | | | | |
| | | | ROGA INDEX (ASH %) | INDEX (%) | | | | | | | | | | | | | | | | | |
| | | | **COKING** | | | | | | | | | | | | | | | | | | |
| | | | MAX RUHR DILATATION (ASH) | % (%) | | | | | | | | | | | | | | | | | |
| | | | MAX CONTRACTION (ASH) | % (%) | | | | | | | | | | | | | | | | | |
| | | | G FACTOR | 1 | | | | | | | | | | | | | | | | | |
| | | | COKE TYPE, GRAY-KING (ASH) | TYPE (%) | | | | | | | | | | | | | | | | | |
| | | | MAX. GIESLER FLUIDITY (ASH) | dd/m (%) | | | | | | | | | | | | | | | | | |
| | | | COKE OVEN TESTS | | | | | | | | | | | | | | | | | | |
| | | | BURN TESTS | | | | | | | | | | | | | | | | | | |
| | | | OTHER TESTS | | | | | | | | | | | | | | | | | | |
| | | | REMARKS | | | | | | | | | | | | | | | | | | |

2 OF 4 K- SHELL - NORTH CENTRAL BLOCK 78(1)A.

# CROWS NEST RESOURCES LIMITED
# EXPLORATION 439

## COAL PROPERTY REVIEW
## COAL QUALITY SUMMARY WORK SHEET - GENERAL

PROVINCE : REGION :

MORE INFORMATION AVAILABLE:
- ☐ REVIEW PART ONE: SUMMARIES
- ☐ SUMMARY SHEET (S)
- ☐ REVIEW PART TWO: FULL LENGTH REPORTS
- ☐ COAL PROPERTY INFORMATION WORK SHEET – GENERAL
- ☐ COAL QUALITY SUMMARY WORK SHEET – GENERAL
- ☐ COAL QUALITY SUMMARY WORK SHEET – METALURGICAL PROPERTIES
- ☐ B.C. COAL LICENCES TENURE STANDING
- ☐

DATE/BY :

BLOCK : CENTRAL

PROJECT : EWIN PASS

USES :

RANK : ASTM INTERNATIONAL — MED VOL BIT

SOURCE : SEAM, ETC. / PROPORTION weight %

THICKNESS : GROSS m/feet; NET m/feet; SAMPLE m/feet

| RAW | CLEAN | BASIS | ANALYSES, TESTS | | 10A | 10B | 9 | 8 | MARKER BED | 7 | 6 | AVERAGE RANGE | AVERAGE |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| • | | | PROXIMATE | | | | | | | | | | |
| | | | SAMPLE TYPE | | | | | | | | | | |
| | | | ASH | % | | | | | | | | | |
| | | | MOISTURE | % | | | | | | | | | |
| | | | HEAT VALUE | MJ/Kg,Kcal/Kg,Btu/lb | | | | | | | | | |
| • | | | PROXIMATE | | | | | | | | | | |
| | | | SAMPLE TYPE | | | | | | | | | | |
| | | | FLOAT SG | | | | | | | | | | |
| | | | YIELD | % | | | | | | | | | |
| | | | ASH | % | 5.6 - 8.4 | 7.7 - 8.4 | 6.1 - 8.3 | 3.9 - 7.1 | 3.4 - 5.3 | 2.7 - 5.0 | 5.5 - 7.8 | 5.0 - 7.2 | 6.1 |
| | | | MOISTURE | % | 0.3 - 0.8 | 0.6 - 1.0 | 0.7 - 1.8 | 0.8 - 1.2 | 0.6 - 1.1 | 0.8 - 1.9 | 0.9 - 2.2 | 0.7 - 1.4 | 1.1 |
| | | | VOLATILE MATTER | % | 21.6 - 29.0 | 21.7 - 29.5 | 21.2 - 26.4 | 24.6 - 27.8 | 27.2 - 29.6 | 24.2 - 30.3 | 30.3 - 31.0 | 24.4 - 29.1 | 26.7 |
| | | | FIXED CARBON | % | | | | | | | | | |
| | | | HEAT VALUE | MJ/Kg,Kcal/Kg,Btu/lb | | | | | | | | | |
| | | | ULTIMATE | | | | | | | | | | |
| | | | SAMPLE TYPE | | | | | | | | | | |
| | | | C | % | | | | | | | | | |
| | | | H | % | | | | | | | | | |
| | | | O | % | | | | | | | | | |
| | | | N TOTAL | % | | | | | | | | | |
| | | | N ORGANIC | % | | | | | | | | | |
| | | | S TOTAL | % | | | | | | | | | |
| | | | S ORGANIC | % | | | | | | | | | |
| | | | S SULPHIDE | % | | | | | | | | | |
| | | | S SULPHATE | % | | | | | | | | | |
| | | | P TOTAL | % | | | | | | | | | |
| | | | ASH | | | | | | | | | | |
| | | | SAMPLE TYPE | | | | | | | | | | |
| | | | FUSION TEMP. INITIAL | °C | | | | | | | | | |
| | | | RESISTIVITY | Ohm-metre | | | | | | | | | |
| | | | GRINDIBILITY (HARDGROVE) | 1 | | | | | | | | | |
| | | | SIZE | mm/in | | | | | | | | | |
| | | | SCREEN ANALYSIS SIZE | mm/in | | | | | | | | | |
| | | | SCREEN ANALYSIS PROPORTIONS | % | | | | | | | | | |
| | | | WASHABILITY TESTS | | | | | | | | | | |
| | | | PETROGRAPHY | | | | | | | | | | |
| | | | REACTIVES | % | | | | | | | | | |
| | | | INERTS | % | | | | | | | | | |
| | | | MEAN REFLECTANCE ($R_o$) | 1 | | | | | | | | | |
| | | | COKE STRENGTH PREDICTED | INDEX | | | | | | | | | |
| | | | COKE STABILITY PREDICTED | INDEX | | | | | | | | | |
| | | | CAKING | | | | | | | | | | |
| | | | FSI (ASH %) | INDEX (%) | 6 - 7 | 5 - 6.5 | 3 - 6 | 7 - 8 | 7 - 7.5 | 6 - 7 | 6.5 - 7.5 | 5.8 - 7.1 | 6.4 |
| | | | ROGA INDEX (ASH %) | INDEX (%) | | | | | | | | | |
| | | | COKING | | | | | | | | | | |
| | | | MAX RUHR DILATATION (ASH) | % (%) | | | | | | | | | |
| | | | MAX CONTRACTION (ASH) | % (%) | | | | | | | | | |
| | | | G FACTOR | 1 | | | | | | | | | |
| | | | COKE TYPE, GRAY-KING (ASH) | TYPE (%) | | | | | | | | | |
| | | | MAX. GIESLER FLUIDITY (ASH) | dd/m (%) | | | | | | | | | |
| | | | COKE OVEN TESTS | | | | | | | | | | |
| | | | BURN TESTS | | | | | | | | | | |
| | | | OTHER TESTS | | | | | | | | | | |
| | | | REMARKS | | | | | | | | | | |

HK-19C

3 OF 4 K-SHELL NORTH CENTRAL Block 78(1)A.

# CROWS NEST RESOURCES LIMITED
# EXPLORATION 439

## COAL PROPERTY REVIEW
## COAL QUALITY SUMMARY WORK SHEET - GENERAL

PROVINCE : REGION :

MORE INFORMATION AVAILABLE:
- ☐ REVIEW PART ONE: SUMMARIES
- ☐ SUMMARY SHEET (S)
- ☐ REVIEW PART TWO: FULL LENGTH REPORTS
- ☐ COAL PROPERTY INFORMATION WORK SHEET – GENERAL
- ☐ COAL QUALITY SUMMARY WORK SHEET – GENERAL
- ☐ COAL QUALITY SUMMARY WORK SHEET – METALURGICAL PROPERTIES
- ☐ B.C. COAL LICENCES TENURE STANDING
- ☐

DATE/BY :

| | |
|---|---|
| BLOCK : | CENTRAL |
| PROJECT : | MT. BANNER WEST |
| USES : | |
| RANK : ASTM INTERNATIONAL | |
| SOURCE : SEAM, ETC. / PROPORTION weight % | |
| THICKNESS : GROSS m/feet; NET m/feet; SAMPLE m/feet | |

RAW | CLEAN | BASIS

## ANALYSES, TESTS

### PROXIMATE

| SAMPLE TYPE | |
|---|---|
| ASH | % |
| MOISTURE | % |
| HEAT VALUE | MJ/Kg, Kcal/Kg, Btu/lb |

### PROXIMATE

| SAMPLE TYPE | | HIGHEST SEAM B | F | G | I | J | K | Q | LOWEST SEAM R | | AVERAGE |
|---|---|---|---|---|---|---|---|---|---|---|---|
| FLOAT SG | | | | | | | | | | | |
| YIELD | % | | | | | | | | | | |
| ASH | % | 7.65 | 8.34 | 15.69 | 4.04 | 9.42 | 8.38 | 9.63 | 8.94 | | 9.01 |
| MOISTURE | % | 5.01 | 1.06 | 1.50 | 1.31 | 3.40 | 1.17 | 0.87 | 1.01 | | 1.92 |
| VOLATILE MATTER | % | 26.29 | 24.06 | 21.46 | 24.64 | 19.48 | 20.83 | 21.43 | 21.54 | | 22.47 |
| FIXED CARBON | % | 61.05 | 66.54 | 61.35 | 70.01 | 67.70 | 69.62 | 68.07 | 68.51 | | 66.61 |
| HEAT VALUE | MJ/Kg, Kcal/Kg, Btu/lb | | | | | | | | | | |

### ULTIMATE

| SAMPLE TYPE | |
|---|---|
| C | % |
| H | % |
| O | % |
| N TOTAL | % |
| ORGANIC | % |
| S TOTAL | % |
| ORGANIC | % |
| SULRHIDE | % |
| SULPHATE | % |
| P TOTAL | % |

### ASH

| SAMPLE TYPE | |
|---|---|
| FUSION TEMP. INITIAL | °C |
| RESISTIVITY | Ohm-metre |

GRINDIBILITY (HARDGROVE) 1

SIZE mm/in

SCREEN ANALYSIS SIZE mm/in / PROPORTIONS %

WASHABILITY TESTS

### PETROGRAPHY

| | |
|---|---|
| REACTIVES | % |
| INERTS | % |
| MEAN REFLECTANCE ($R_o$) | 1 |
| COKE STRENGTH PREDICTED | INDEX |
| COKE STABILITY PREDICTED | INDEX |

### CAKING

| | |
|---|---|
| FSI (ASH %) | INDEX (%) |
| ROGA INDEX (ASH %) | INDEX (%) |

### COKING

| | |
|---|---|
| MAX RUHR DILATATION (ASH) | % (%) |
| MAX CONTRACTION (ASH) | % (%) |
| G FACTOR | 1 |
| COKE TYPE, GRAY-KING (ASH) | TYPE (%) |

MAX. GIESLER FLUIDITY (ASH) dd/m (%)

COKE OVEN TESTS

BURN TESTS

OTHER TESTS

REMARKS

439

# CROWS NEST RESOURCES LIMITED
# EXPLORATION

## COAL PROPERTY REVIEW SUMMARY

MORE INFORMATION AVAILABLE:
- ☐ REVIEW PART ONE: SUMMARIES
- ☐ SUMMARY SHEET(S)
- ☐ REVIEW PART TWO: FULL LENGTH REPORTS
- ☐ COAL PROPERTY INFORMATION WORK SHEET – GENERAL
- ☐ COAL QUALITY SUMMARY WORK SHEET – GENERAL
- ☐ COAL QUALITY SUMMARY WORK SHEET – METALURGICAL PROPERTIES
- ☐ B.C. COAL LICENCES TENURE STANDING
- ☐

PROVINCE : BRITISH COLUMBIA

REGION : SOUTHEASTERN B.C.
KOOTENAY LAND DISTRICT
EAST KOOTENAY COAL AREA, OR
CROWSNEST COAL FIELDS

DATE / BY :

| | BLOCK | | CENTRAL | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ID | PROJECT | | LINE CREEK PIT AREA | LINE CREEK NORTH | LINE CREEK TOTAL | MT. TEPEE | HORSESHOE RIDGE | MT. MICHAEL WEST | MT. MICHAEL EAST | EWIN PASS | MT. BANNER WEST | MT. BANNER EAST | CENTRAL BLOCK TOTAL |
| | AREA (C=CROWN, F=FREEHOLD) | Ha | | | | | | 1250 | 350 | 600 | 800 | 1200 | |
| | LOCATION | | | | | | | | | | | | |
| | NTS/SEC.-TWP.-RGE.-W.OF MERIDIAN | | | | | | | | | | | | |
| $ | AFE | No. | | | | | | | | | | | |
| | BUDGET | $ | | | | | | | | | | | |
| | WORK REQUIREMENT/COMMITMENT | $ | | | | | | | | | | | |
| | JOINT VENTURE | | | | | | | | | | | | |
| | TOTAL EXPENDITURES | $ | | | | | | | | | | | |
| | SHELL POTENTIAL ÷ CLASSIFICATION | | | | | | | | | | | | |
| ACCESS | RAILWAY POINT NEAREST (DISTANCE) | km | | | | | | 6.4 | 9.6 | 7.3 | 1.0 | 3.0 | |
| | TOWNSITE NEAREST (DISTANCE) | km | | | | | | | | 60.8 | | | |
| | PORT/NORTH AMERICAN MARKET DISTANCE | km | | | | | | | | | | | |
| | ROAD ACCESS TO PROPERTY | km | | | | | | 2.8 | 11.5 | 2.8 | 2.8 | 3.2 | |
| | ON PROPERTY | km | | | | | | 4.7 | 3.4 | 3.6 | — | 3.8 | |
| | ENVIRONMENTAL/LAND USE CLASSIFICATION | | | | | | | | | | | | |
| | POSSIBLE RESTRICTIONS | | | | | | | | | | | | |
| GEOLOGY | STRATIGRAPHY | | | | | | | | | | | | |
| | SEAMS THICKER THAN 1.0 m/feet | No | | | | | | 5 | 11 | 9 | 8 | — | |
| | AGGREGATE THICKNESS GROSS (NET) | m | | | | | | 21.6 | 61.0 | 52.0 | 21.7 | — | |
| | DIP RANGE | DEGREES | | | | | | 45 - 60 | 45 - 60 | 30 - 40 | 30 - 45 | ≅ 40° | |
| | STRUCTURE | | | | | | | EAST LIMB FORDING SYNCLINE UPLIFTED SIDE OF THRUST FAULT | EAST LIMB FORDING SYNCLINE REPEATED COAL SEAMS DUE TO FAULTING | EAST LIMB FORDING SYNCLINE COAL REPEATED DUE TO FAULTING | EAST LIMB FORDING SYNCLINE FOLDED AND FAULTED | AXIS OF ALEXANDER SYNCLINE FOLDING & FAULTING PRESENT | |
| EXPLORATION | EXPLORATION | | | | | | | | | | | | |
| | LEVEL, COMPLETION | | | | | | | 10% | 20% | 50% | 5% | 5% | |
| | TOPOGRAPHIC CONTROL | | | | | | | 1:50 000, 1:50 000, 1:2000 prelim. | 1:50 000, 1:5000, 1:2000 | 1:50 000, 1:5000, 1:2000 | 1:50 000, 1:5000 prelim. | 1:50 000, 1:5000 prelim. | |
| | GEOLOGICAL MAPPING | | | | | | | 1:50 000, 1:5000 prelim. | 1:50 000, 1:5000 prelim. | 1:50 000, 1:5000 prelim, 1:2000 prelim | 1:50 000 | 1:50 000, 1:5000 prelim. | |
| | HAND TRENCHES (LENGTH) | m | | | | | | 19 | 435 | 60 | — | 30 | |
| | BULLDOZER TRENCHES, ROAD CUTS | No. | | | | | | | | 5 | | | |
| | TEST PITS | No. | | | | | | | | | | | |
| | ADITS (LENGTH INC. X-CUTS) | No. (m/feet) | | | | | | | | | | | |
| | DRILLING: ROTARY (LENGTH, CORE) | No. (m/feet) | | | | | | | | | | | |
| | DIAMOND (LENGTH) | No. (m/feet) | | | | | | | | | | | |
| | DOWNHOLE GEOPHYSICAL LOGS | TYPE | | | | | | | | | | | |
| | OTHER | | | | | | | | | | | | |
| RESERVES | COAL RESOURCES(*)/RESERVES(**) TOTAL | MILLION METRIC TONNES | | | | | | | | | | | |
| | PROVEN SURFACE/OVERBURDEN RATIO | " | | | | | | | | 18.33 x $10^6$ | | | |
| | UG | " | | | | | | | | — | | | |
| | PROBABLE SURFACE/OVERBURDEN RATIO | " | | | | | | | | 11.98 x $10^6$ | | | |
| | UG | " | | | | | | | | | | | |
| | • POSSIBLE SURFACE/OVERBURDEN RATIO | " | | | | | | | | | | | |
| | UG | " | | | | | | | | | | | |
| | • HYPOTHETICAL SURFACE/OVERBURDEN RATIO | " | | | | | | | | | | | |
| | UG | " | | | | | | 13.0 x $10^6$ | | | 12.0 x $10^6$ | 10.0 x $10^6$ | |
| | C=CLEAN, R=RAW RECOVERABLE, G=GEOL. IN PLACE | | | | | | | | 15.0 x $10^6$ | | | | |
| MINING | MINING METHOD | | | | | | | | | | | | |
| | (MODEL)TYPE | | | | | | | | | | | | |
| | DESIGN, FEASIBILITY STUDIES | | | | | | | | | | | | |
| | DISCLOSURES | | | | | | | | | | | | |
| | PRODUCTION LEVEL TARGETED (CLEAN COAL) | MM TONNES YEAR | | | | | | | | | | | |
| | COMMENCEMENT CONSIDERED | | | | | | | | | | | | |
| QUALITY | COAL RANK | | | | | | | | | MED. VOL. BIT. | | | |
| | POSSIBLE END USES | | | | | | | | | COKING | | | |
| | CLEANING (PLANT) REQUIREMENT | | | | | | | | | | | | |
| | YIELD (ASH) FORESEEN | (%) | | | | | | | | | | | |
| | RAW MOISTURE | % | | | | | | | | 8.0 ± 1.0 | | | |
| | RAW ASH | % | | | | | | | | 9.0 ± 0.5 db | | | |
| | YIELD (SG) | % | | | | | | | | | | | |
| | CLEAN ASH | % | | | | | | | | | | | |
| | HEAT VALUE | MJ, Kcal/kg, Btu/lb | | | | | | | | 15,400 Btu/lb daf | | | |
| | SULPHUR | % | | | | | | | | | | | |
| | FSI | | | | | | | | | 5 - 8 | | | |
| | MEAN REFLECTANCE (Ro) | | | | | | | | | | | | |
| | COKE STABILITY PREDICTED | INDEX | | | | | | | | | | | |
| | COKE STRENGTH PREDICTED | INDEX | | | | | | | | | | | |
| | COKING TESTS | | | | | | | | | | | | |
| | TUMBLER COKE STABILITY – SIEVE SIZES | mm | | | | | | | | | | | |
| | ASTM/JIS/MICUM – PROPORTION RETAINED | CUMULATIVE % | | | | | | | | | | | |

SEAMS

| | HIGHEST | | | | | | | LOWEST |
|---|---|---|---|---|---|---|---|---|
| | B | F | G | I | J | K | Q | R |
| 8.0 ± 1.0 | 5.01 | 1.06 | 1.50 | 1.31 | 3.40 | 1.17 | 0.87 | 1.01 |
| 9.0 ± 0.5 db | 7.65 | 6.34 | 5.86 | 4.04 | 9.42 | 8.38 | 9.63 | 8.94 |

DATA DERIVED FROM CNR REPORT BY N. ELPHINSTONE (1951)

| MISC. | REMARKS |
|---|---|



1/R 156

K-SHELL-NORTH-CENTRAL
BLOCK-78(2)A.

TOPS,
CROSS SECTIONS
ECT.. -1978

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Crows Nest Resources Limited

EXPLORATION

NORTH CENTRAL BLOCK

B.C.

GEOLOGICAL - AERIAL PHOTOGRAPH

MAP No. 1

Re-3 Heli-North-Central Claim Trip

| | |
|---|---|
| AUTHOR: J. FISHER | SCALE: 1:5000 |
| DATE: APRIL 1979 | REVISED: |
| By Author/Agency | ENCLOSURE No.: |
| | DRAWING No.: HK-21 |

LEGEND

- PHOTO OBSERVED DIP 1°-3°, 3°-10°, 10°-20°, 20°-40°, 40°-NEARLY VERTICAL
- PHOTO OBSERVED VERTICAL BEDDING
- ANTICLINAL AXIS WITH OR WITHOUT PLUNGE ARROWS
- SYNCLINAL AXIS
- FAULT: - MINOR
- UPTHROWN SIDE
- DEFINED
- APPROXIMATE
- ASSUMED
- FORMATION BOUNDARY
- HIGH ANGLE REVERSED FAULT
- LOW ANGLE THRUST FAULT
- TRIANGLES ON UPTHROWN BLOCK
- JKA - KOOTENAY FM.
- J - PERMIT GP.
- KEY BED OR BEDDING TRACE
- COAL (BLOCK ON DIP SIDE)
- CONGLOMERATE
- SANDSTONE
- MEASURED STRAT. SECTION
- MEASURED STRIKE & DIP

GEOLOGICAL PHOTO-MAP INDEX

| | | | |
|---|---|---|---|
| MAP 5 | MAP 6 | MAP 7 | MAP 8 |
| MAP 1 | MAP 2 | MAP 3 | MAP 4 |

N

NW61778 00- 007 LINE 4-S 24-07-78

1:5000

Map No. 1

1

**Crows Nest Resources Limited**

EXPLORATION

NORTH CENTRAL BLOCK

B.C.

# 439

GEOLOGICAL - AERIAL PHOTOGRAPH

MAP No. 2

Elko - Alexander Creek - Blaze Zr(2)A

AUTHOR: J. FISHER | SCALE: 1:5000 | ENCLOSURE No.:

DATE: APRIL 1979 | REVISED: | DRAWING No.: HK-21A

To Accompany

LEGEND

PHOTO OBSERVED DIP, 1°-3°, 3°-10°, 10°-25°, 25°-45°, 45°-NEARLY VERTICAL

PHOTO OBSERVED VERTICAL BEDDING

ANTICLINAL AXIS WITH OR WITHOUT PLUNGE ARROWS

SYNCLINAL AXIS

FAULT; MINOR — DEFINED, APPROXIMATE, ASSUMED

UPTHROWN SIDE

FORMATION BOUNDARY

HIGH ANGLE REVERSED FAULT — TRIANGLES ON UPTHROWN BLOCK

LOW ANGLE THRUST FAULT

JKK - KOOTENAY FM.

JH - PERMIC GR.

KEY BED OR BEDDING TRACE

COAL (BLOCK ON DIP SIDE)

CONGLOMERATE

SANDSTONE

MEASURED STRAT. SECTION

MEASURED STRIKE & DIP

GEOLOGICAL REPORT - MAP INDEX

| | | | |
|---|---|---|---|
| MAP 5 | MAP 6 | MAP 7 | MAP 8 |
| MAP 1 | MAP 2 | MAP 3 | MAP 4 |

Z

Map No. 2

NW61778 00- 005 LINE 4-S 24-07-78

1:5000

Map No. 3

**Crows Nest Resources Limited**

EXPLORATION

NORTH CENTRAL BLOCK

B.C.

439

GEOLOGICAL - AERIAL PHOTOGRAPH

MAP No. 3

Re: Shale - North Central - Page 78(a)

| | |
|---|---|
| AUTHOR: J. FISHER | SCALE: 1:5000 |
| DATE: APRIL 1979 | REVISED: — |
| To Accompany | DRAWING No: HK-218 |

LEGEND

PHOTO OBSERVED DIP, 1°-3°, 3°-10°, 10°-20°, 20°-40°, 40°-NEARLY VERTICAL

PHOTO OBSERVED VERTICAL BEDDING

ANTICLINAL AXIS — WITH OR WITHOUT PLUNGE ARROWS

SYNCLINAL AXIS

FAULT(+) - MINOR — U = UPTHROWN SIDE — LOCATED OR APPROXIMATE — ASSUMED

FORMATION BOUNDARY

HIGH ANGLE REVERSED FAULT — TRIANGLES ON UPTHROWN BLOCK

LOW ANGLE THRUST FAULT

JKK - KOOTENAY FM.

JF - FERNIE GP.

KEY BED ON BEDDING TRACE

COAL (BLOCK ON DIP SIDE)

CONGLOMERATE

SANDSTONE

MEASURED STRAT. SECTION

33 / 335 — MEASURED STRIKE & DIP

GEOLOGICAL PLOTS-MAP INDEX

| | | | |
|---|---|---|---|
| MAP 5 | MAP 6 | MAP 7 | MAP 8 |
| MAP 1 | MAP 2 | MAP 3 | MAP 4 |

N

NW61778 — 003 — LINE 4-S — 24-07-78

1:5000

3

**Crows Nest Resources Limited**

EXPLORATION

NORTH CENTRAL BLOCK

LE

GEOLOGICAL - AERIAL PHOTOGRAPH

MAP No. 4

PRE-3 HELE - NORTH-CENTRAL BLOCK 78(3)A

| | |
|---|---|
| AUTHOR: J. FISHER | SCALE: 1:5000 |
| DATE: APRIL 1979 | REVISED: |
| | To Accompany |
| ENCLOSURE No.: | DRAWING No. MK-21C |

LEGEND

- PHOTO OBSERVED DIR. 1°-3°, 3°-10°, 10°-20°, 20°-40°, 40° NEARLY VERTICAL
- PHOTO OBSERVED VERTICAL SECOND
- ANTICLINAL AXIS — WITH OR WITHOUT PLUNGE ARROWS
- SYNCLINAL AXIS
- FAULT; - MINOR — DEFINED
- UPTHROWN SIDE — APPROXIMATE
- DOWNTHROWN SIDE — ASSUMED
- FORMATION BOUNDARY
- HIGH ANGLE REVERSED FAULT — TRIANGULES ON UPTHROWN BLOCK
- LOW ANGLE THRUST FAULT
- JKK - KOOTENAY FM.
- JF - FERNIE GP.
- KEY BED OR SECOND TRACE
- COAL (BLOCK ON DIP SIDE)
- CONGLOMERATE
- SANDSTONE
- MEASURED STRAT. SECTION
- 35/326 MEASURED STRIKE & DIP

GEOLOGICAL INDEX-MAP INDEX

| | | | |
|---|---|---|---|
| MAP 5 | MAP 6 | MAP 7 | MAP 8 |
| MAP 1 | MAP 2 | MAP 3 | MAP 4 |

N

NW61778 00 001 LINE 4-S 24-07-78

1:5000

4

**Crows Nest Resources Limited**

EXPLORATION

NORTH CENTRAL BLOCK
B.C.

439

GEOLOGICAL - AERIAL PHOTOGRAPH

MAP No. 5

PR-SHELL - NORTH-CENTRAL - BLOCK 72(2)A.

| | | |
|---|---|---|
| AUTHOR: J. FISHER | SCALE: 1:5000 | ENCLOSURE No: |
| DATE: APRIL 1979 | REVISED: | DRAWING No: HK - 21D |
| To Accompany | | |

## LEGEND

- PHOTO OBSERVED DIP, 1°-3°, 3°-10°, 10°-25°, 25°-45°, 45°-NEARLY VERTICAL
- PHOTO OBSERVED VERTICAL BEDDING
- ANTICLINAL AXIS
- SYNCLINAL AXIS
  (WITH OR WITHOUT PLUNGE ARROWS)
- FAULT; f - MINOR; U - UPTHROWN SIDE (DEFINED, APPROXIMATE, ASSUMED —?—?—)
- FORMATION BOUNDARY (DEFINED, APPROXIMATE, ASSUMED —?—?—)
- HIGH ANGLE REVERSED FAULT
- LOW ANGLE THRUST FAULT
  (TRIANGLES ON UPTHROWN BLOCK)
- JKk - KOOTENAY FM.
- JP - PERNIE GP.
- KEY BED OR BEDDING TRACE
- COAL (BLOCK ON DIP SIDE)
- CONGLOMERATE
- SANDSTONE
- MEASURED STRAT. SECTION
- 55/356 MEASURED STRIKE & DIP

GEOLOGICAL PHOTO-MAP INDEX

| | | | |
|---|---|---|---|
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| MAP 1 | MAP 2 | MAP 3 | MAP 4 |

Z

LEGEND HERE

**Crows Nest Resources Limited**

EXPLORATION

NORTH CENTRAL BLOCK
B.C.

439

GEOLOGICAL - AERIAL PHOTOGRAPH

MAP No. 6

K

BE-SHELL-NORTH CENTRAL-BLOCK 78(2)A

| | | |
|---|---|---|
| AUTHOR: J. FISHER | SCALE: 1:5000 | ENCLOSURE No: |
| DATE: APRIL 1979 | REVISED: | DRAWING No: HK - 21E |
| To Accompany | | |

## LEGEND

- PHOTO OBSERVED DIP. 1°-3°, 3°-10°, 10°-25°, 25°-45°, 45°-NEARLY VERTICAL
- PHOTO OBSERVED VERTICAL BEDDING
- ANTICLINAL AXIS
- SYNCLINAL AXIS
  (WITH OR WITHOUT PLUNGE ARROWS)
- FAULT; f - MINOR
- U — UPTHROWN SIDE
- FORMATION BOUNDARY
  (DEFINED, APPROXIMATE, ASSUMED —?—?—)
- HIGH ANGLE REVERSED FAULT
- LOW ANGLE THRUST FAULT
  (TRIANGLES ON UPTHROWN BLOCK)
- JKk - KOOTENAY FM.
- Jf - FERNIE GP.
- KEY BED OR BEDDING TRACE
- COAL (BLOCK ON DIP SIDE)
- CONGLOMERATE
- SANDSTONE
- MEASURED STRAT. SECTION
- 55/336 MEASURED STRIKE & DIP

GEOLOGICAL PHOTO-MAP INDEX

| | | | |
|---|---|---|---|
| MAP 5 | MAP 6 | MAP 7 | MAP 8 |
| MAP 1 | MAP 2 | MAP 3 | MAP 4 |

N

FERNIE SYNCLINE

Map No

**Crows Nest Resources Limited**

EXPLORATION

NORTH CENTRAL BLOCK
B.C.

439

GEOLOGICAL - AERIAL PHOTOGRAPH

MAP No. 7

K
BP - SHELL - NORTH - CENTRAL - BLOCK 76(2)A.

| | | |
|---|---|---|
| AUTHOR: J. FISHER | SCALE: 1:5000 | ENCLOSURE No: |
| DATE: APRIL 1979 | REVISED: | DRAWING No: HK - 21F |
| To Accompany | | |

## LEGEND

- PHOTO OBSERVED DIP, 1°-3°, 3°-10°, 10°-25°, 25°-45°, 45°-NEARLY VERTICAL
- PHOTO OBSERVED VERTICAL BEDDING
- ANTICLINAL AXIS
- SYNCLINAL AXIS
  (WITH OR WITHOUT PLUNGE ARROWS)
- FAULT; f - MINOR (DEFINED, APPROXIMATE, ASSUMED)
- U — UPTHROWN SIDE
- FORMATION BOUNDARY
- HIGH ANGLE REVERSED FAULT
- LOW ANGLE THRUST FAULT
  (TRIANGLES ON UPTHROWN BLOCK)
- JKk - KOOTENAY FM.
- Jf - FERNIE GP.
- KEY BED OR BEDDING TRACE
- COAL (BLOCK ON DIP SIDE)
- CONGLOMERATE
- SANDSTONE
- MEASURED STRAT. SECTION
- 55/356 MEASURED STRIKE & DIP

GEOLOGICAL PHOTO-MAP INDEX

| | | | |
|---|---|---|---|
| MAP 5 | MAP 6 | MAP 7 | MAP 8 |
| MAP 1 | MAP 2 | MAP 3 | MAP 4 |

N

N

JKK

JKK

**Crows Nest Resources Limited**

EXPLORATION

NORTH CENTRAL BLOCK
B.C.

439

GEOLOGICAL - AERIAL PHOTOGRAPH

MAP No. 8

K

PR. SHELL - NORTH-CENTRAL-BLOCK 78(2)A

| | | |
|---|---|---|
| AUTHOR: J. FISHER | SCALE: 1:5000 | ENCLOSURE No: |
| DATE: APRIL 1979 | REVISED: | DRAWING No: HK - 21G |
| To Accompany | | |

LEGEND

PHOTO OBSERVED DIP, 1°-3°, 3°-10°, 10°-25°, 25°-45°, 45°-NEARLY VERTICAL

PHOTO OBSERVED VERTICAL BEDDING

ANTICLINAL AXIS

SYNCLINAL AXIS

WITH OR WITHOUT PLUNGE ARROWS

FAULT; f - MINOR

U — UPTHROWN SIDE

FORMATION BOUNDARY

DEFINED

APPROXIMATE

ASSUMED —?—?—

HIGH ANGLE REVERSED FAULT

LOW ANGLE THRUST FAULT

TRIANGLES ON UPTHROWN BLOCK

JKk - KOOTENAY FM.

Jf - FERNIE GP.

KEY BED OR BEDDING TRACE

COAL (BLOCK ON DIP SIDE)

CONGLOMERATE

SANDSTONE

MEASURED STRAT. SECTION

55/356 MEASURED STRIKE & DIP

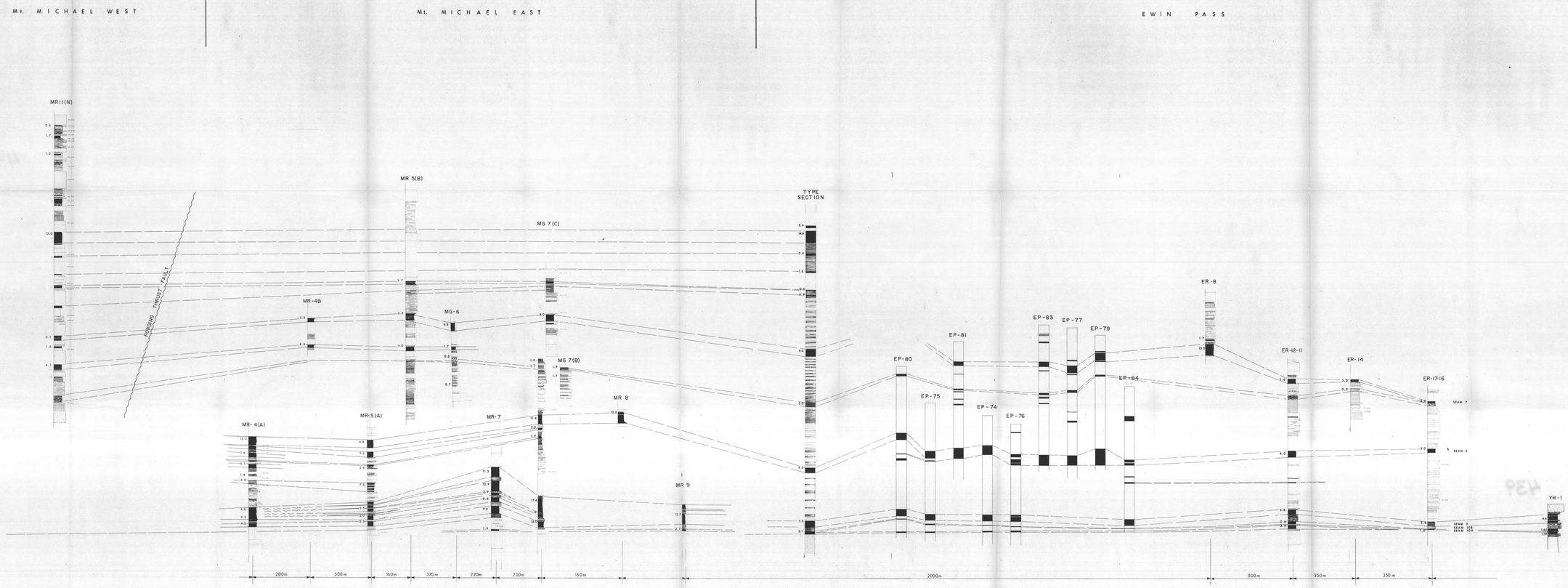
GEOLOGICAL PHOTO-MAP INDEX

| | | | |
|---|---|---|---|
| MAP 5 | MAP 6 | MAP 7 | MAP 8 |
| MAP 1 | MAP 2 | MAP 3 | MAP 4 |

N

Map No. #8

N




439

K.
Mt. Shaw - North Central Block 78(6)A

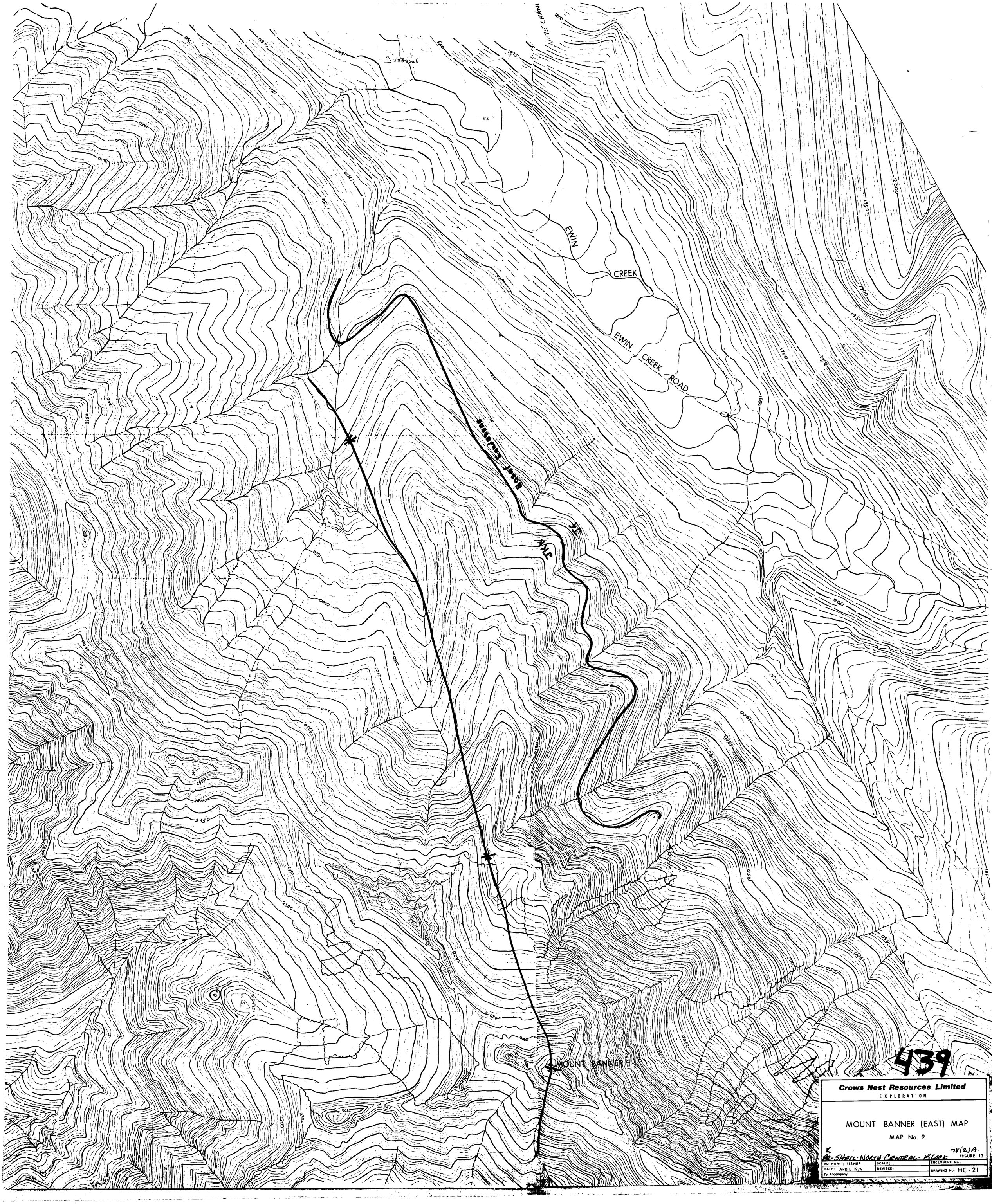
**Crows Nest Resources Limited**

EXPLORATION

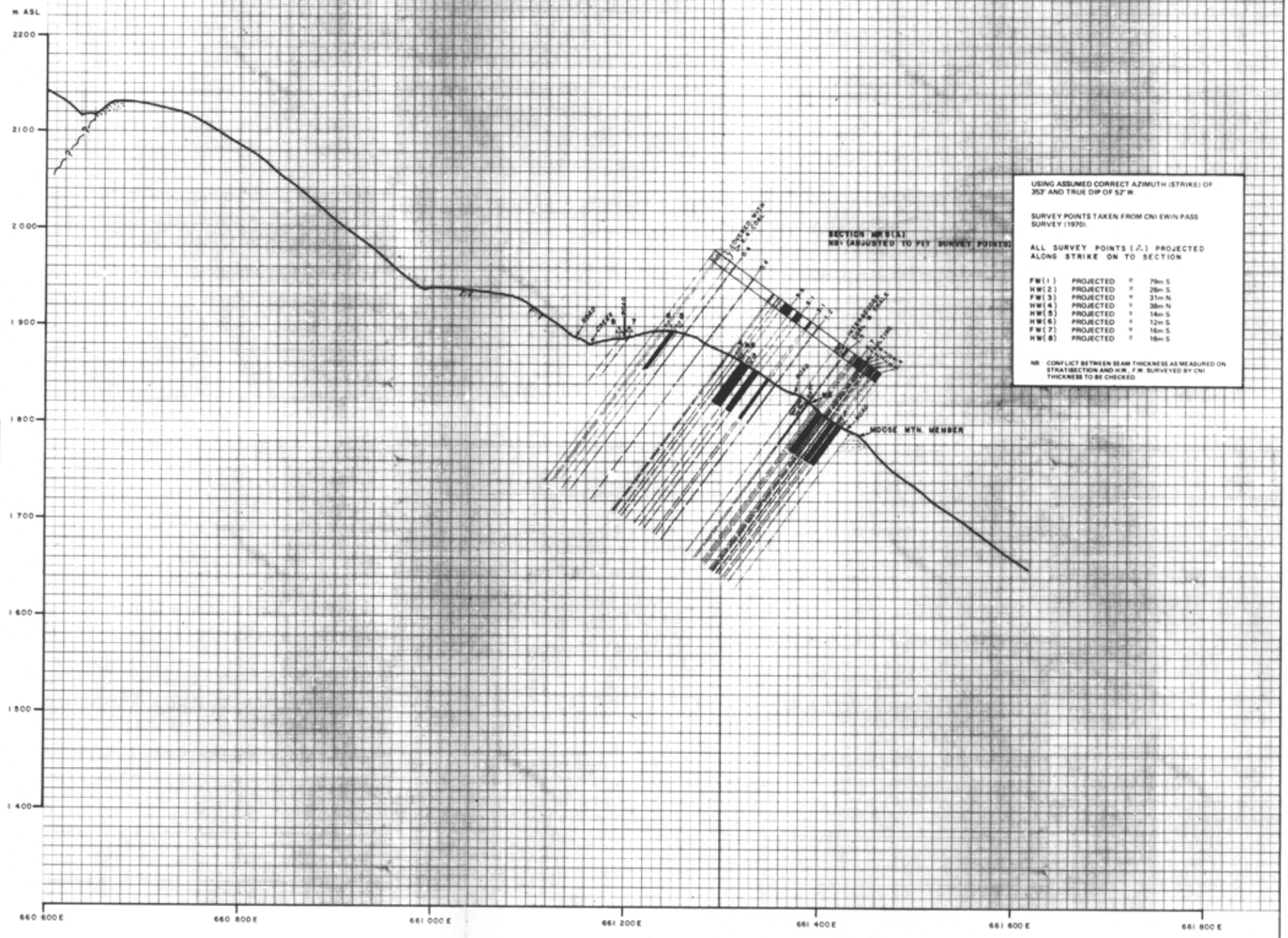
NORTH CENTRAL BLOCK
B.C.

# STRATIGRAPHIC SECTIONS CORRELATION CHART

| | | |
|---|---|---|
| AUTHOR: J. FISHER | SCALE: 1:1000 | ENCLOSURE No. 1 |
| DATE: APR. 1979 | REVISED: | DRAWING No. HE-21 |
| By Accompany | | |


EWIN
CREEK
EWIN
CREEK
ROAD
Basalt Sulphur
JNK
SE
MOUNT BANNER E
439
Crows Nest Resources Limited
EXPLORATION
MOUNT BANNER (EAST) MAP
MAP No. 9
78(2)A.
FIGURE 13
AUTHOR: J. FISHER
DATE: APRIL 1979
To Accompany
SCALE:
REVISED:
ENCLOSURE No:
DRAWING No: HC - 21

SECTION MR 5(A)




Crows Nest Resources Limited
EXPLORATION

NORTH CENTRAL BLOCK
B.C.
MT. MICHAEL (EAST)

CROSS SECTION MR-5(A)

FIGURE 14

AUTHOR G SLOAN SCALE 1:2000 ENCLOSURE No.
DATE FEB. 27, 79 REVISED DRAWING No. HG-198
To Accompany

439

K
BR-SHELL-NORTH-CENTRAL-BLOCK 78(2)A.

CROSS SECTION MR-11 (DRAWN ON AZIMUTH OF 265°)
AZIMUTH OF 342° = STRIKE OF BEDDING
ANGLE OF 51° = TRUE DIP OF BEDDING

SECTION MR-11
PROJECTED ON AT 45° APPARENT DIP (TRUE DIP ≅ 51°)

PROJECTED MAXIMUM OF ≅ 300 METRES FROM BASE OF #7 COAL TO TOP OF MOOSE MOUNTAIN MEMBER

m ASL
2500
2400
2300
2200
2100
2000
1900
1800

659 000 E

K
RR-SHELL-NORTH-CENTRAL-BLOCK 78(2)A.

**Crows Nest Resources Limited**
EXPLORATION

NORTH CENTRAL BLOCK
B.C.
Mt. MICHAEL (WEST)

CROSS SECTION MR-11

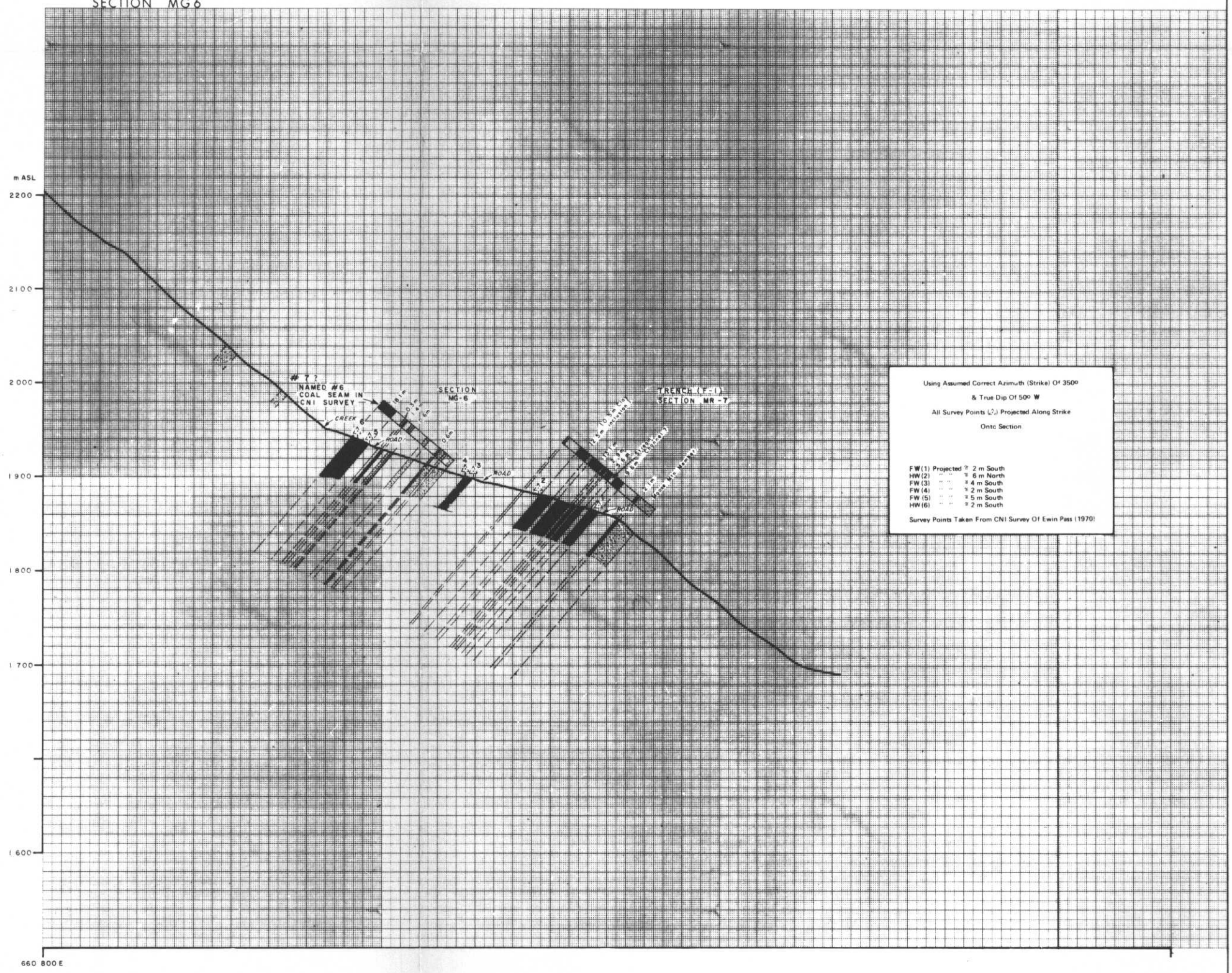
FIGURE 15

| | | |
|---|---|---|
| AUTHOR G. SLOAN | SCALE 1:5000 | ENCLOSURE No |
| DATE 79-03-01 | REVISED | DRAWING No HG-191 |
| To Accompany | | |

439

439

SECTION MG6

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K.
Re-SHELL · NORTH CENTRAL BLOCK 78(2)A.

**Crows Nest Resources Limited**
EXPLORATION

NORTH CENTRAL BLOCK
B.C.
MT. MICHAEL (EAST)

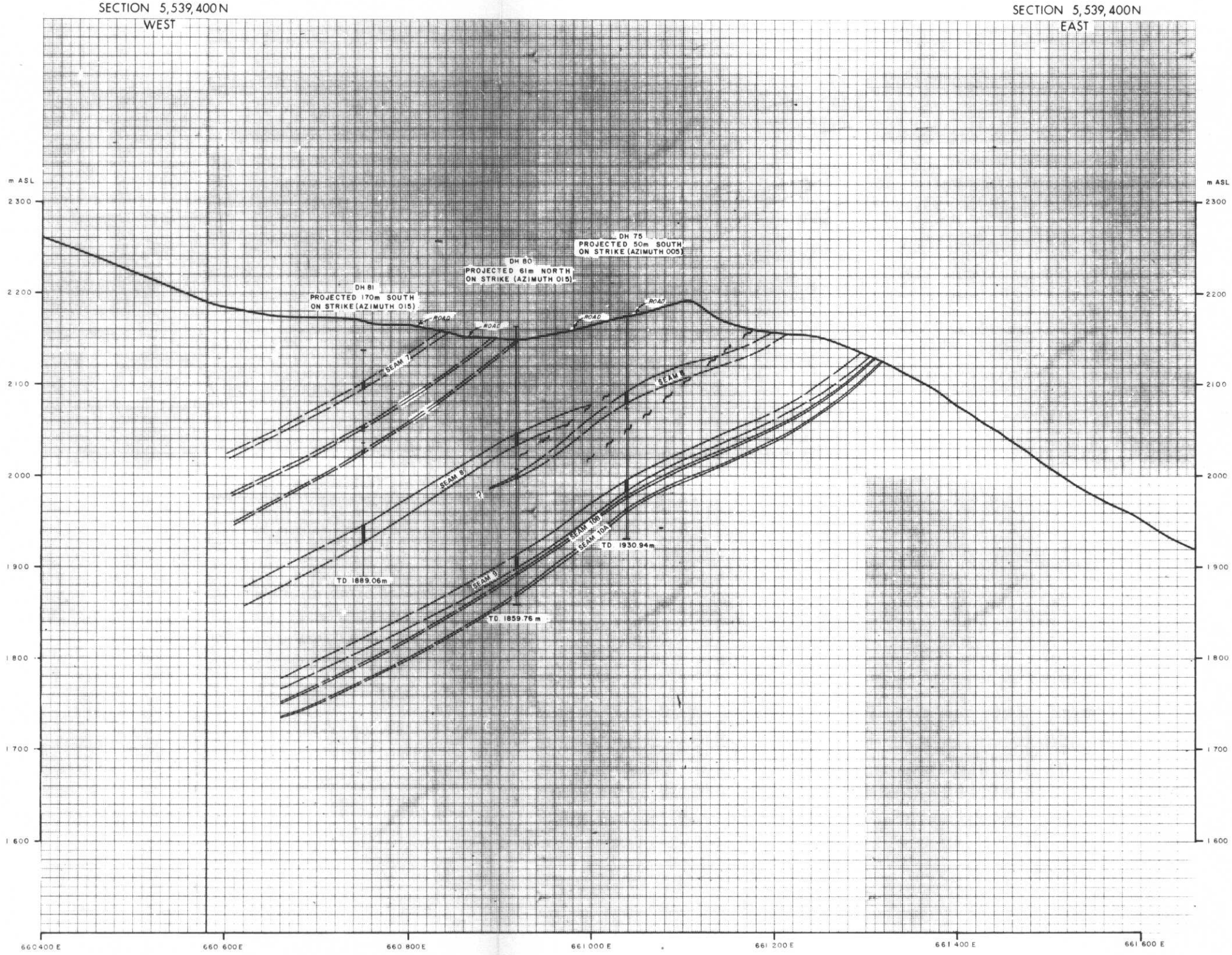
CROSS SECTION MG-6

FIGURE 16

| | | |
|---|---|---|
| AUTHOR G SLOAN | SCALE 1:2000 | ENCLOSURE No |
| DATE FEB 27, 1979 | REVISED | DRAWING No HG-19 |
| To Accompany | | |

SECTION 5,539,400N
WEST

SECTION 5,539,400N
EAST




PEN

439

K
K - SHELL - NORTH - CENTRAL BLOCK 78(2)A.

**Crows Nest Resources Limited**
EXPLORATION

NORTH CENTRAL BLOCK
B.C.
EWIN PASS

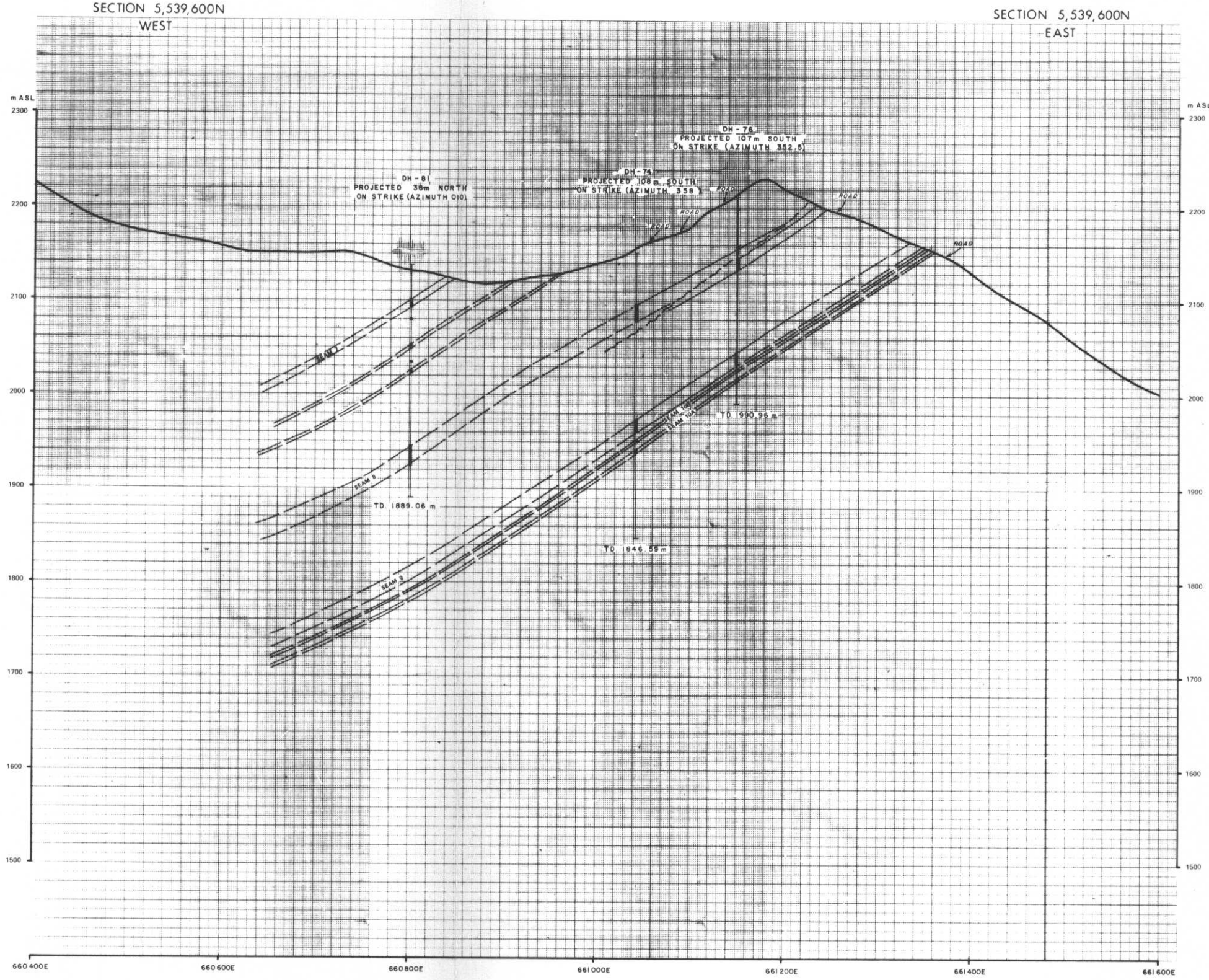
CROSS SECTION 5,539,400N

FIGURE 17

AUTHOR G. SLOAN SCALE 1:2000 DRAWING NO. HG-19E
DATE FEB 1979 REVISED

SECTION 5,539,600N
WEST

SECTION 5,539,600N
EAST




**Crows Nest Resources Limited**
EXPLORATION

NORTH CENTRAL BLOCK
BC
EWIN PASS

CROSS SECTION 5,539,600N

FIGURE 18

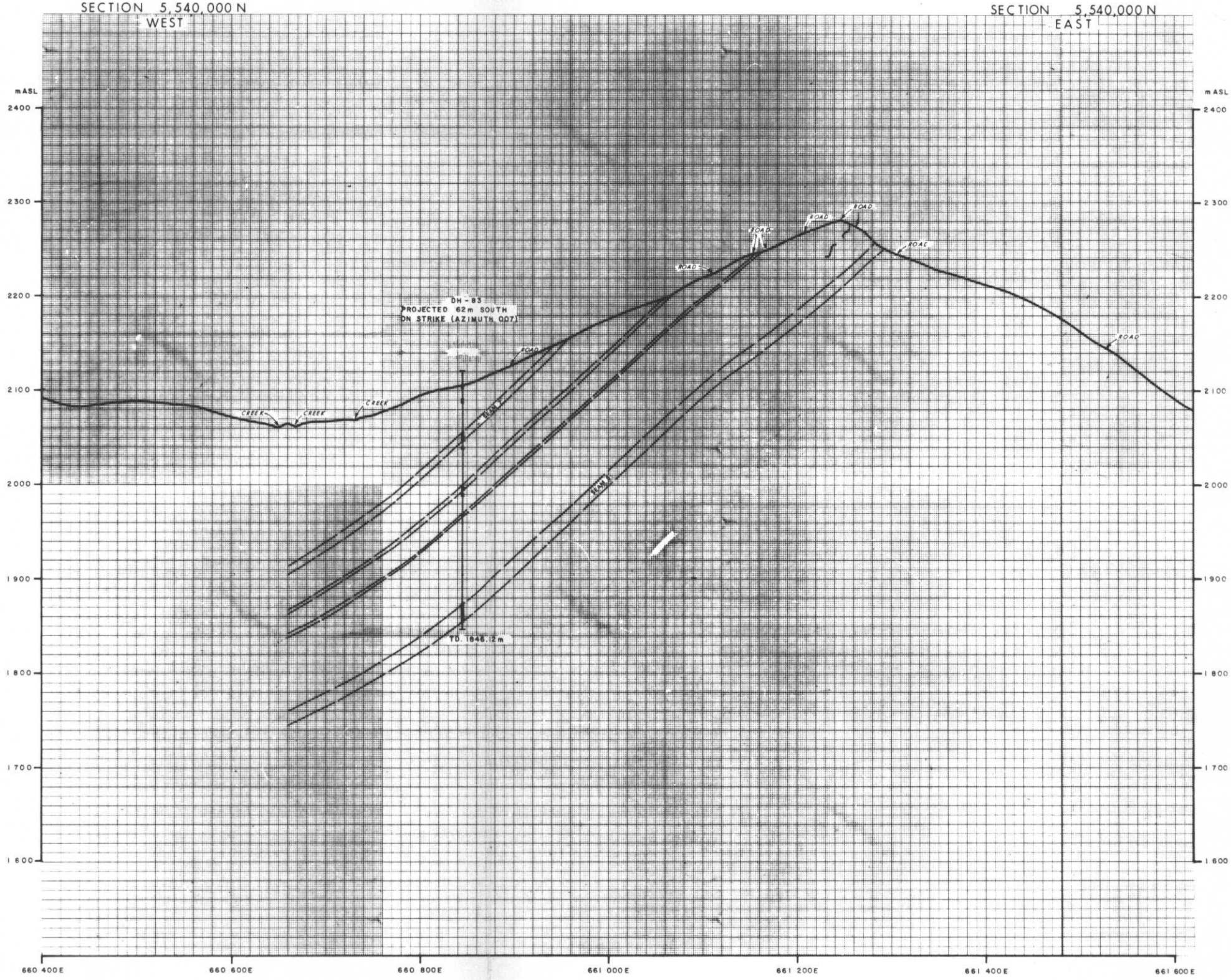
| | | |
|---|---|---|
| AUTHOR G SLOAN | SCALE 1:2000 | ENCLOSURE No |
| DATE FEB 1979 | REVISED | DRAWING No HG-19G |
| To Accompany | | |

439

K
~~K~~B - SHELL - NORTH - CENTRAL - BLOCK 78(2)A.

SECTION 5,540,000 N
WEST

SECTION 5,540,000 N
EAST

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Crows Nest Resources Limited
EXPLORATION

NORTH CENTRAL BLOCK
B.C.
EWIN PASS

CROSS SECTION 5,540,000N

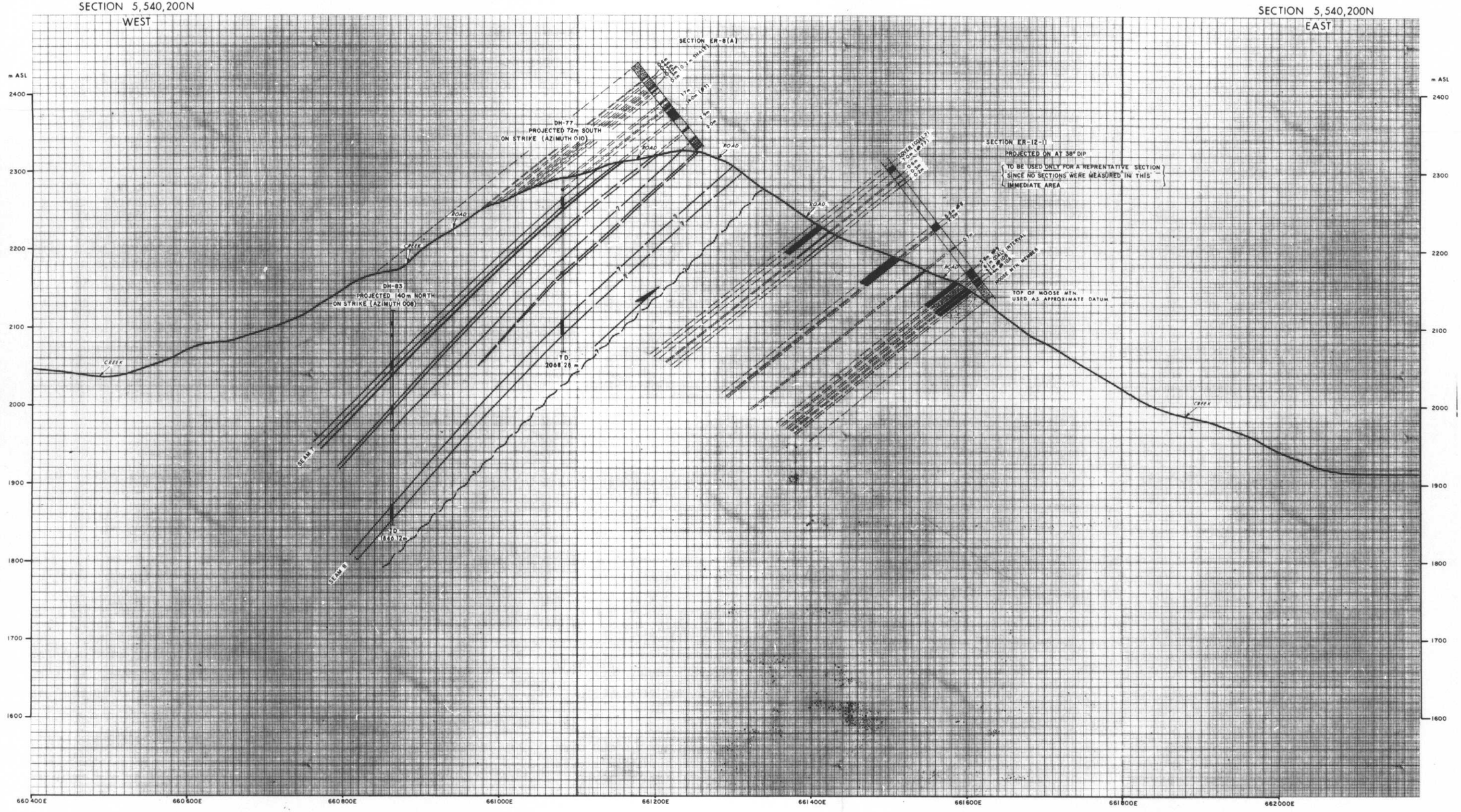
FIGURE 19

AUTH: D. G. SLOAN SCALE: 1:2000
DATE: FEB 23, 1979 ENCLOSURE NO.
DRAWING NO: HG-19C

K
~~XX~~-SHELL-NORTH-CENTRAL-BLOCK 78(2)A.

SECTION 5,540,200N
WEST

SECTION 5,540,200N
EAST




439

K
RE-SHEET - NORTH CENTRAL BLOCK 78(2)A.

**Crows Nest Resources Limited**
EXPLORATION

NORTH CENTRAL BLOCK
B.C.
EWIN PASS

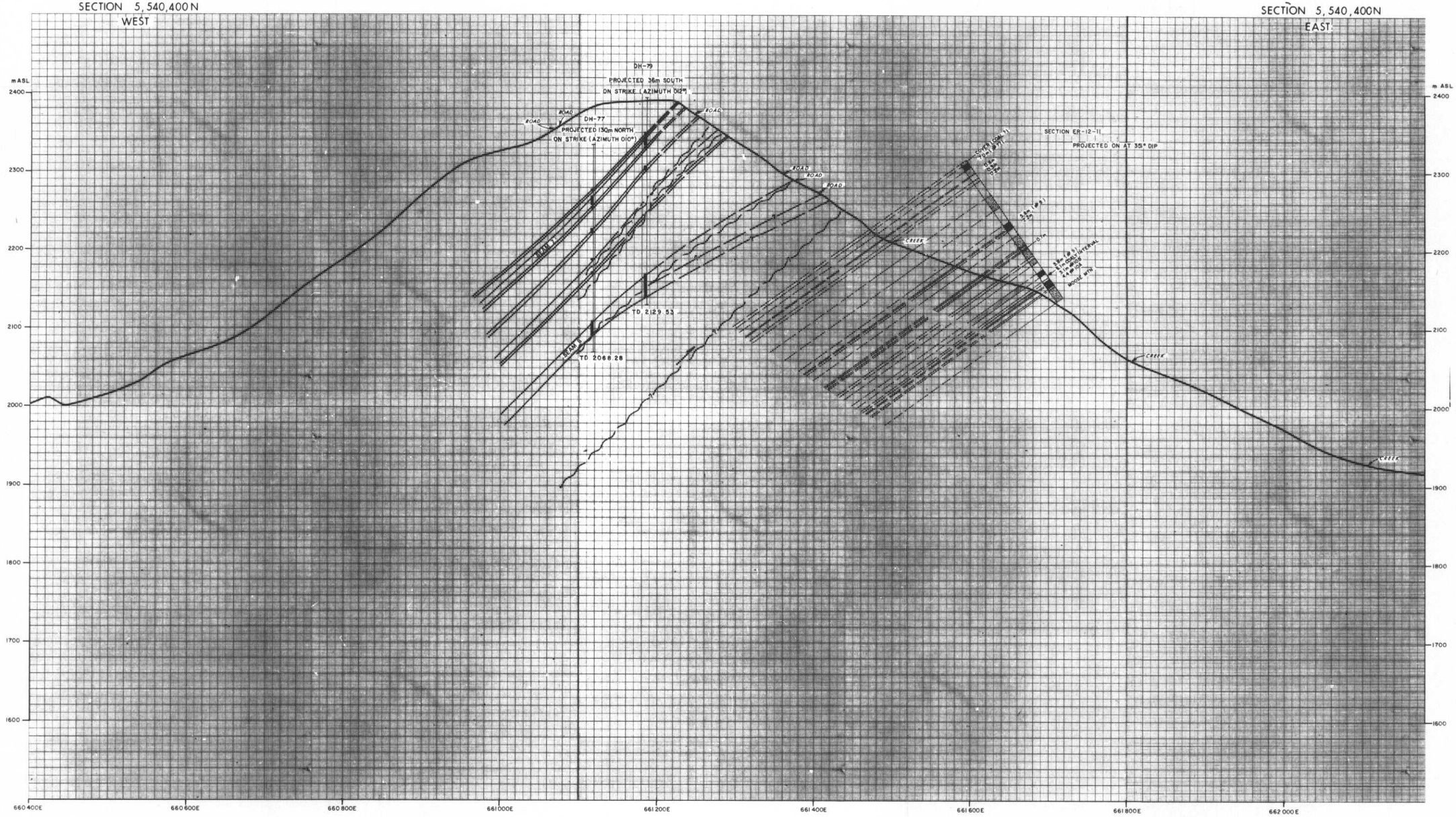
CROSS SECTION 5,540,200 N

FIGURE 20

| | | |
|---|---|---|
| AUTHOR G.SLOAN | SCALE 1:2000 | ENCLOSURE No |
| DATE FEB 1979 | REVISED | DRAWING No HG-19A |
| To Accompany | | |

SECTION 5,540,400 N
WEST

SECTION 5,540,400N
EAST

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K
Re. SHELL - NORTH - CENTRAL - BLOCK 78(2)A

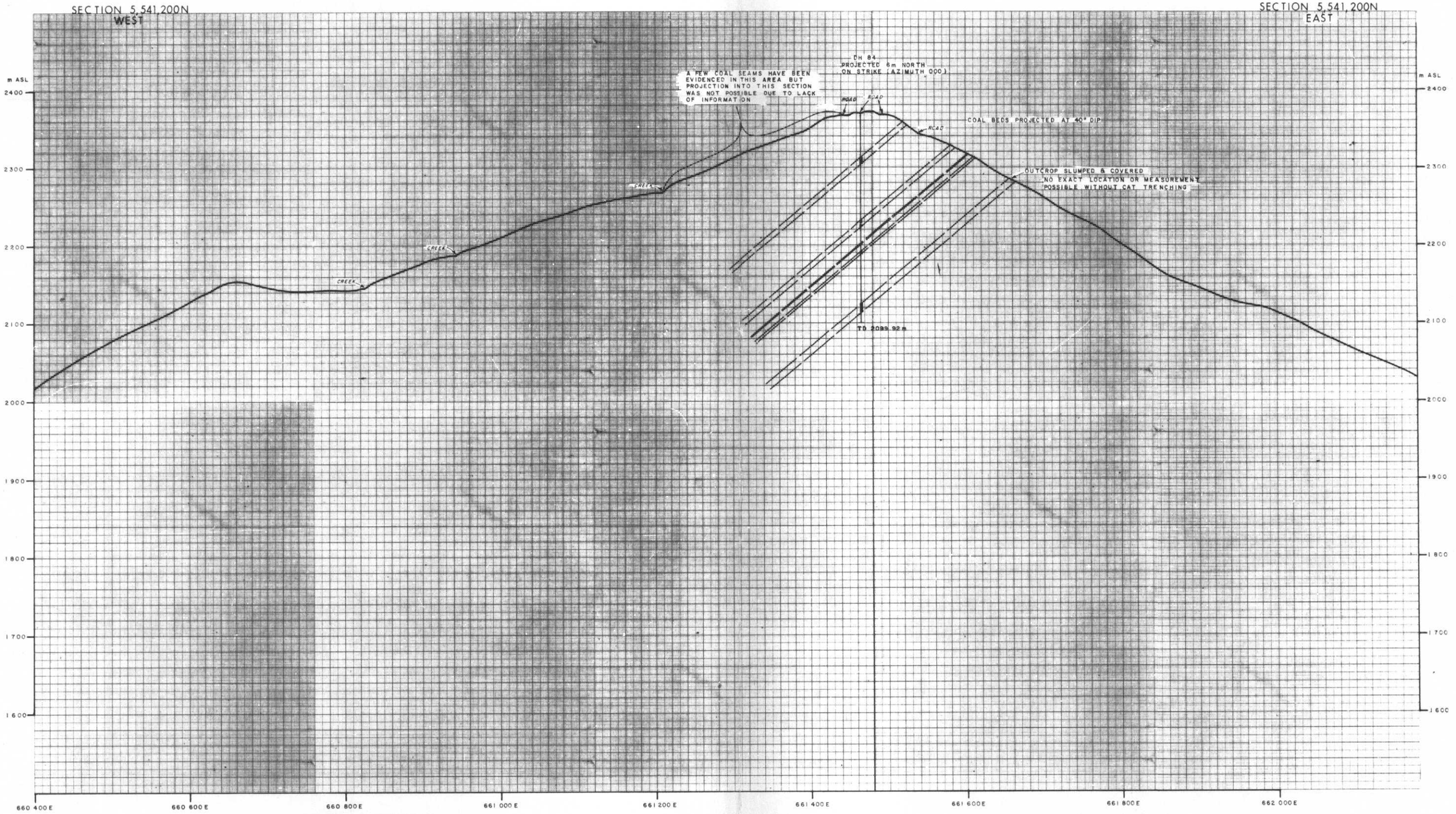
**Crows Nest Resources Limited**
EXPLORATION

NORTH CENTRAL BLOCK
B.C.
EWIN PASS

SECTION 5,540,400 N

FIGURE 21

| | | |
|---|---|---|
| AUTHOR G SLOAN | SCALE 1:2000 | ENCLOSURE No. |
| DATE FEB. 1979 | REVISED | DRAWING No. HG - 19 H |
| To Accompany | | |




439

K
~~Ac~~-SHELL - NORTH CENTRAL BLOCK 78 (2)A.

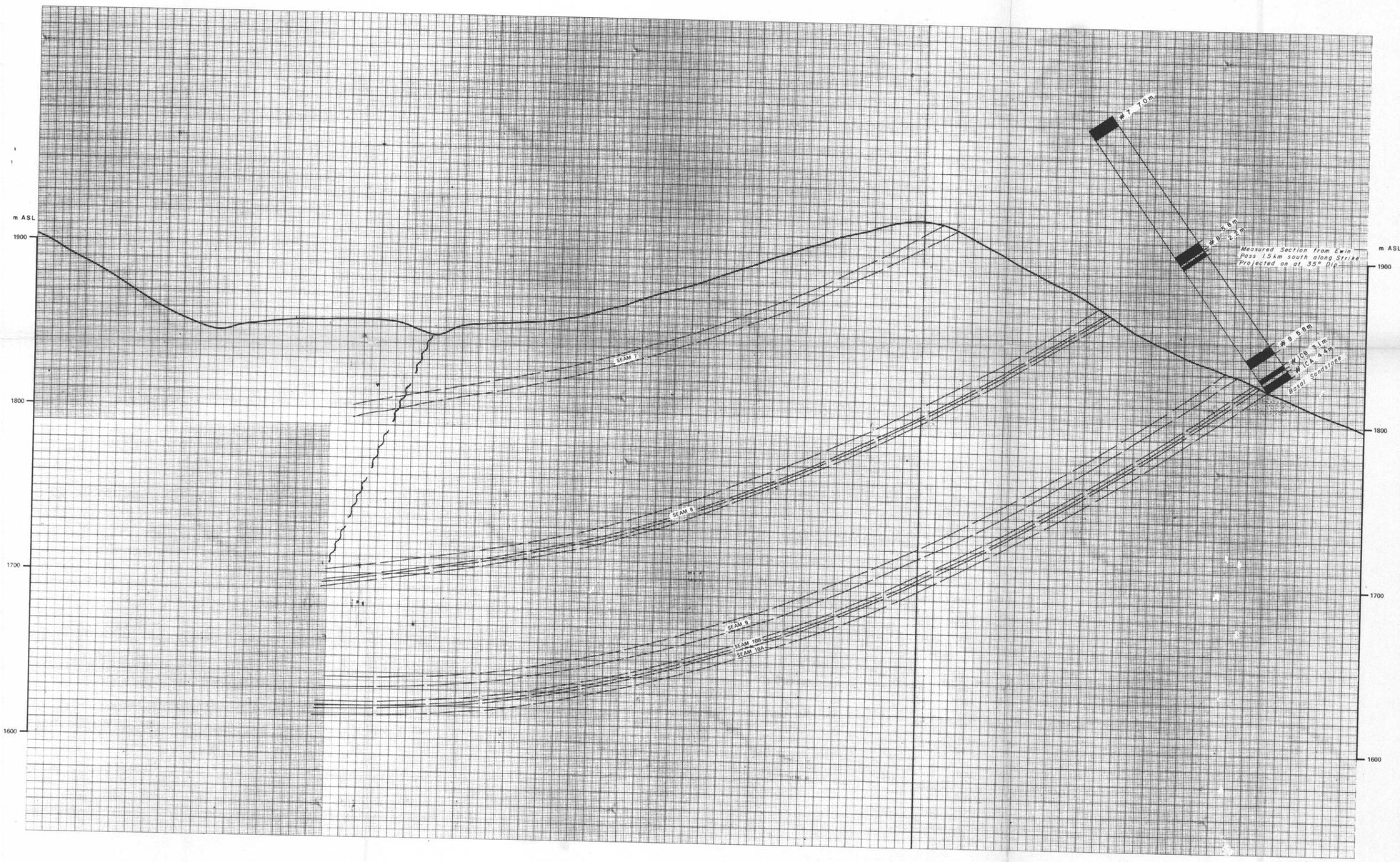
**Crows Nest Resources Limited**
EXPLORATION

NORTH CENTRAL BLOCK
B.C.
EWIN PASS

CROSS SECTION 5,541,200N

FIGURE 22

| | |
|---|---|
| AUTHOR: D. SLOAN SCALE: 1:2000 | ENCLOSURE No. |
| DATE: FEB. 27, 1979 REVISED | DRAWING No. HG-19F |
| To Accompany | |




439

K
SHELL · NORTH · CENTRAL · BLOCK · 78(2)17.

**Crows Nest Resources Limited**
EXPLORATION

NORTH CENTRAL BLOCK
B.C.
Mt. BANNER (EAST)

Possible Structural Conditions based upon Aerial Photo Interpretation

FIGURE 23

AUTHOR J. FISHER SCALE 1:2000 ENCLOSURE
DATE FEB. 26, 1979 REVISED
To Accompany
DRAWING No. HG-19D

# CROWS NEST INDUSTRIES

## DRILL HOLE LOGS

EWIN PASS

SCALE 1" = 50'

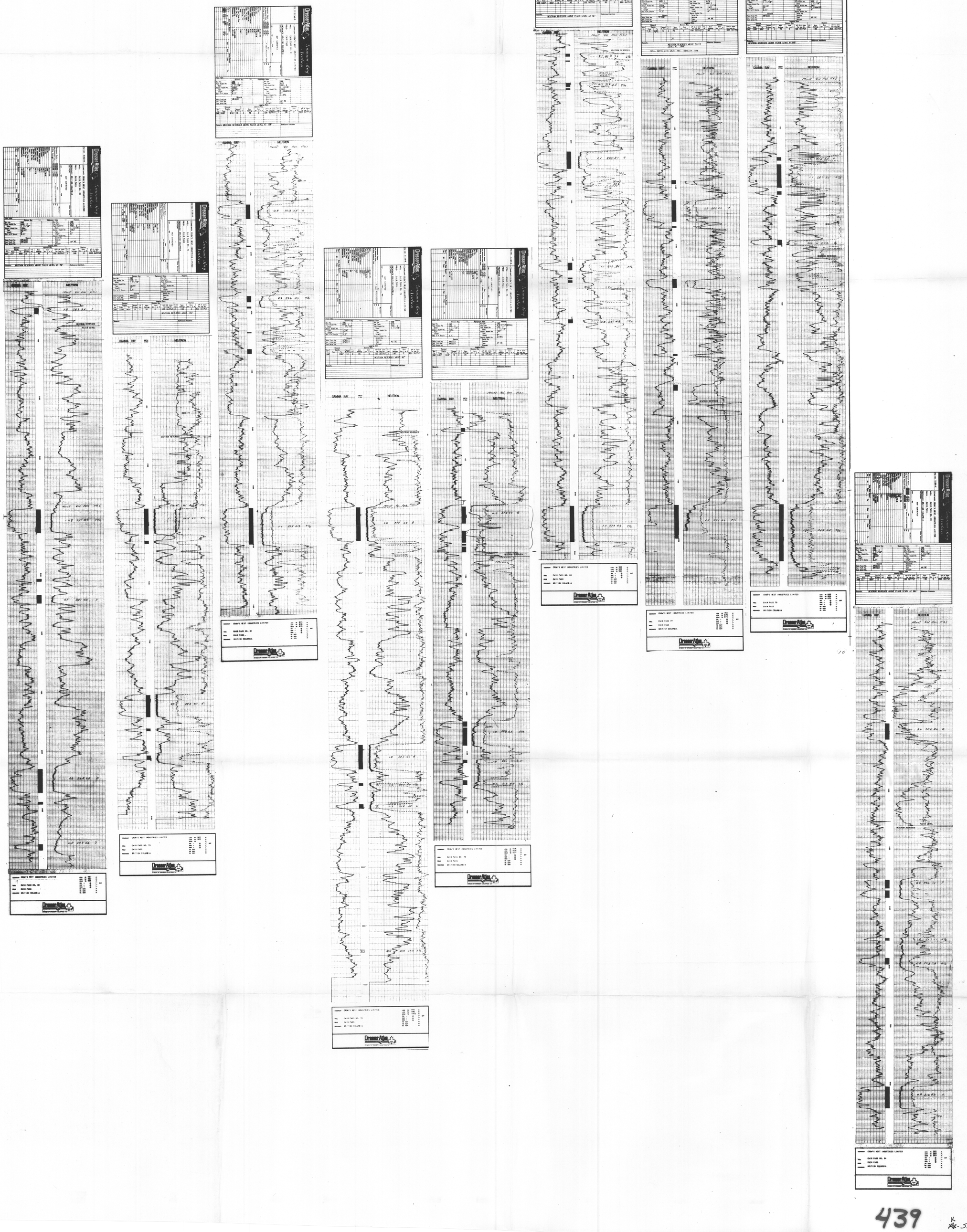





FIGURE 24
EWIN PASS
FILE NO. VD-20
SCALE 1"=50'

DRILL HOLE LOGS.

439

K
PAC-SHELL-NORTH CENTRAL BLOCK-78(2)A.

439 MG-7(C)

# STRATIGRAPHIC SECTION

DESIGNATION: K-SHELL-NORTH-CENTRAL BLOCK 78(2)A.

PART _____ OF _____

PROJECT: NORTH CENTRAL BLOCK B.C.

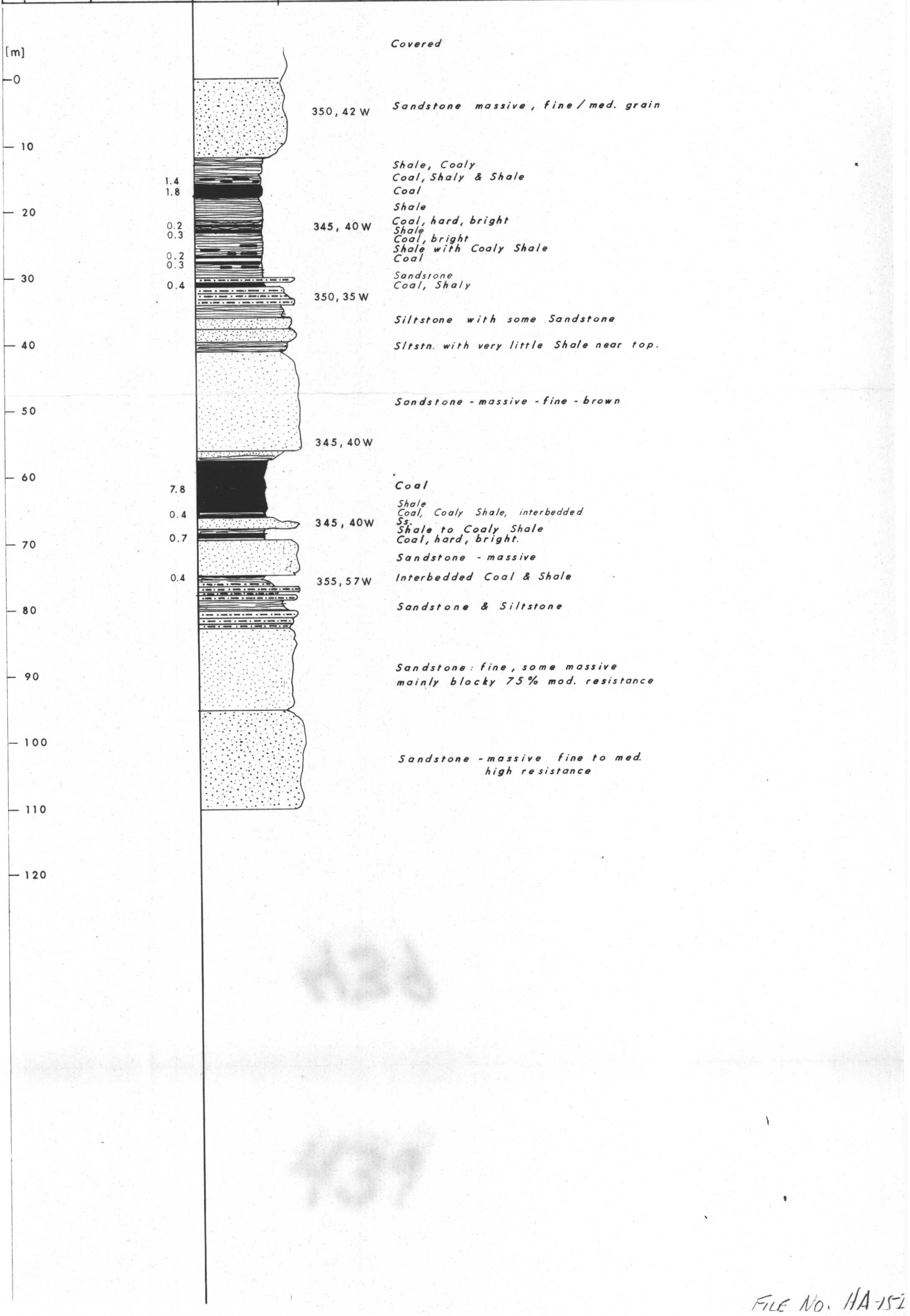
AUTHOR: J. FISHER

DATE: 1978 NOV. 20

AREA: MT. MICHAEL (E)

SOURCE OF DATA:

LOCATION: SECTION (15-5) MG-7(C)




FILE NO. HA-15-2

439

K
~~SHELL~~ - SHELL - NORTH - CENTRAL - BLOCK 78(2)A.

# STRATIGRAPHIC SECTION

DESIGNATION:

PART _____ OF _____

PROJECT: NORTH CENTRAL BLOCK B.C.

AUTHOR: J. FISHER

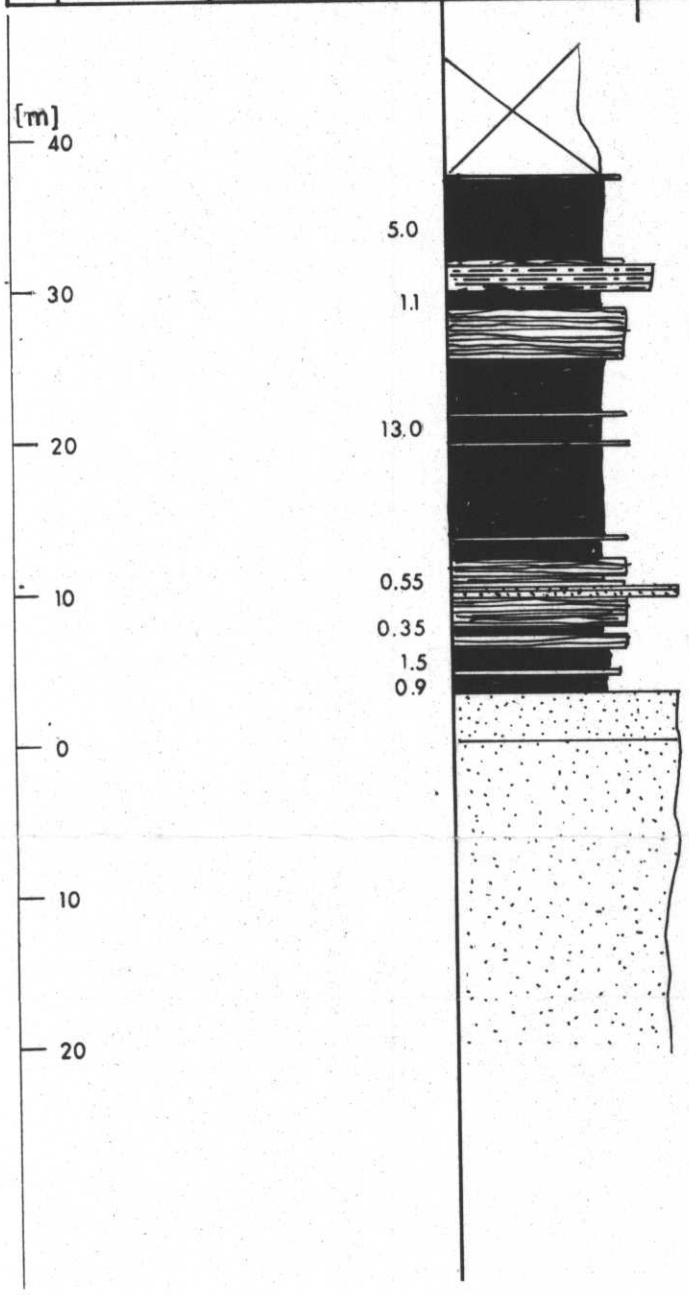
DATE: 1979 MAR. 14

AREA: MT. MICHAEL (E)

SOURCE OF DATA:

LOCATION: SECTION (7-1) MR-9

| SCALE | CONTROL POINT | INTERVAL | LITHOLOGY | STRIKE & DIP | DESCRIPTION | | SAMPLE |
|---|---|---|---|---|---|---|---|
| | | | | | MAIN | AMPLIFIED | |




Covered section above
Sh. dk. gy.

Coal. slightly shaly between 1.5-2.0m. from bottom
Sh. carb.
Sltstn, Coal seam (.15) near top, dk. gy.
Coal lense

Sh. dk. gy, carb.

Coal with shaly band at
13.38, 0.2 thick
at 19.58 & 21.48, 0.1 thick
at 16.53, 0.12 ironstone band

Sh. dk. gy, fissile, coaly & carb.
Coal split
Sh.
Ss. fine, at top grading to a Sh.
Sh. silty, fissile, dk. gy.
Coal
Sh. dk. gy, small coal lenses
Coal
Sh. coaly & carb, silty at bottom
Coal
Ss. fine, thinly bedded, med. gy, top 2m. carb.

Moose Mtn, Ss.

439

439

# STRATIGRAPHIC SECTION

DESIGNATION: K Pr-SHELL-NORTH-CENTRAL BLOCK 78(2) A.

PART ____ OF ____

PROJECT: NORTH CENTRAL BLOCK B.C.

AUTHOR: J. FISHER

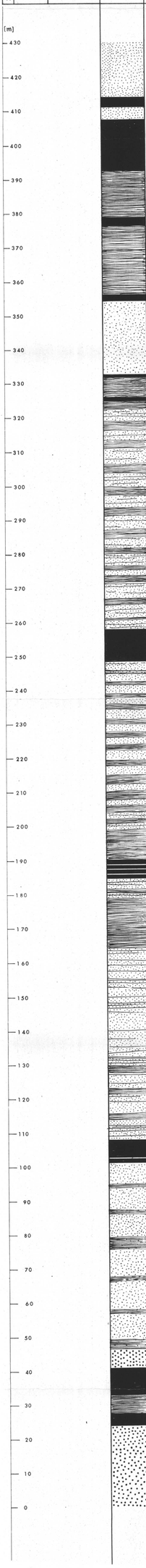
DATE: 1978 NOV. 2

AREA: EWIN PASS

SOURCE OF DATA:

LOCATION: TYPE SECTION

| SCALE | CONTROL POINT | INTERVAL | LITHOLOGY | STRIKE & DIP | DESCRIPTION MAIN | DESCRIPTION AMPLIFIED | SAMPLE |
|---|---|---|---|---|---|---|---|




Sandstone roof

Coal

Sandstone

Coal

Shale

Coal

Shale

Coal

Sandstone

Coal

Shale

Coal

Sandstone & Shale Interbedded.

Coal, Disturbed

Sandstone & Shale Interbedded

Shale

Coal with partings

Shale, grading upwards to Sandstone

Sandstone

Sandstone & Shale Interbedded.

Coal

Coal

Sandstone

Sandstone & Shale Interbedded

Coal

Shale

Coal, faulted & thickened

Sandstone, coarse, base, Kootenay formation

FILE NO. HA1:

439

# STRATIGRAPHIC SECTION

DESIGNATION: PRE-SHELL - NORTH-CENTRAL - BLOCK 78(2)B.

PART _____ OF _____

PROJECT: NORTH CENTRAL BLOCK B.C.

AUTHOR: J. FISHER DATE: 1978 NOV. 20

AREA: EWIN PASS

SOURCE OF DATA:

LOCATION: SECTION ( J - 26 - 1 ) ER - 17 - 16

| SCALE | CONTROL POINT | INTERVAL (m) | LITHOLOGY | STRIKE & DIP | DESCRIPTION MAIN | DESCRIPTION AMPLIFIED | SAMPLE |
|---|---|---|---|---|---|---|---|
| [m] 180 | | | | | Shale, Sltstn & Ss inter(conc. at top) | | |
| 170 | | | | | Covered ( carb. shale),(coal may be but unlikely) | | |
| 160 | | 2.5 | | | Coal dirty & weathered<br>Coaly Shale & Sltstn inter. | } Unknown if measured Bedrock. | |
| 150 | | | | | Sltstn(Sandy) grey<br>Ss. massive fine<br>Sltstn., blocky Ss | | |
| 140 | | | | | Ss., massive, med. grey<br>Covered<br>Ss. blocky/massive med. grey<br>Covered ( Sltstn? ) | | |
| 130 | | | | | Ss. blocky med./fine<br>Covered (Ss. ? )<br>Grey Sltstn. | | |
| 120 | | | | | Ss. grey, weather br, massive, med./coarse<br>Covered<br>Ss. v.fine grey/br. | | |
| 110 | | | | | Covered<br>Shale top Sltstn. to v. fine Ss. | | |
| 100 | | 5.0 | | | Coal dirty weathered<br>Sltstn & fine Ss. inter. | | |
| 90 | | | | | Ss. blocky med. to fine | | |
| 80 | | | | 345, 33W | Ss. med./coarse grey massive<br>Covered ( Ss. ? )<br>Ss. as below<br>Covered | | |
| 70 | | | | | Ss. massive, med./coarse<br>Covered<br>Ss. massive with some thinly bed interbeds | | |
| 60 | | | | | Covered<br>Ss. massive lt. grey med./fine | | |
| 50 | | | | | Covered<br>Ss. massive med./fine<br>Ss. & Sltstn. interbedded | | |
| 40 | | | | 335, 33W | Ss. massive fine<br>Sltstn. & Ss. interbedded. | | |
| 30 | | | | | Ss. massive<br>Ss., med. massive, grey | | |
| 20 | | | | | Sltstn. large cave in middle<br>Ss. , massive, grey, fine | | |
| 10 | | 0.7<br>0.7<br>0.6<br>2.0<br>0.8 | | | Covered ( Sltstn? )<br>Coal & Shale interbeds | | |
| 0 | | 0.2 | | | All seams badly weathered.<br>Shale, Carb. with some Sltstn.<br>Coal<br>Sltstn.<br>Moose Mtn. Ss. | | |
| 170 | | | | | | | |
| 180 | | | | | | | |
| 190 | | | | | | | |
| 200 | | | | | | | |

FILE NO. HA-15

439

K
~~PB~~-SHELL-NORTH-CENTRAL-BLOCK-78(2)4.

# STRATIGRAPHIC SECTION

DESIGNATION: | PART _____ OF _____

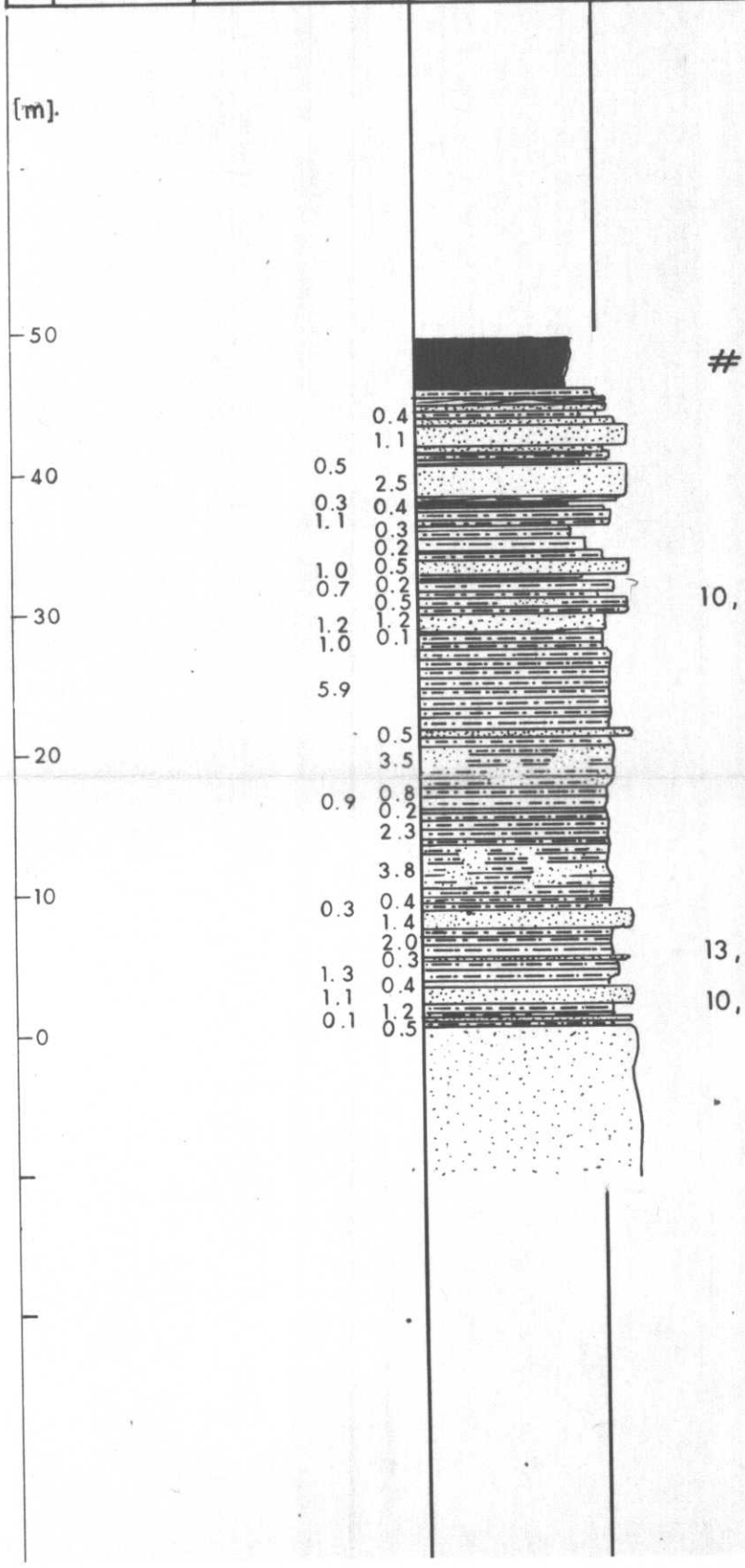
PROJECT: NORTH CENTRAL BLOCK B.C.

AREA: EWIN PASS

LOCATION: SECTION (21-5) ER-14

AUTHOR: J. FISHER | DATE: 1979 MAR. 5

SOURCE OF DATA:




| DESCRIPTION | |
|---|---|
| MAIN | AMPLIFIED |
| | Coal ? (thickness unknown) |
| | Sltstn. |
| | Shale |
| | Ss. |
| | Coal 0.1m |
| | Sltstn. |
| | Shale |
| | Ss; Fine gy. |
| | Coal |
| | Sltstn; br. |
| | Shale & Coal |
| | Coal |
| | Sltstn. |
| | Ss; gy. |
| | Coal, bright, hard |
| | Sltstn. & Ss. interbedded. |
| | Sltstn. |
| | Ss. & Sltstn. interbedded |
| | Sltstn; br. & gy. |
| | Coal |
| | Sltstn. Shaly; bk. |
| | Sltstn; interbedded with some concretions. |
| | Ss; lt. gy.; fine gr. |
| | Sltstn. interbedded Ss. |
| | Sltstn. |
| | Sltstn; gy, some concretions. |
| | Sltstn; bk. |
| | Sltstn. with gy. Ss. interbedded, lt. & dk. gy; top yellow |
| | Sltstn. with 20% Ss. interbed, med. gy. |
| | Sltstn; massive. |
| | Ss; massive; fine gr; some laminar bedding. |
| | Sltstn; lt. br; gy. near top. |
| | Ss. massive, lt. gy. |
| | Ss. & Sltstn. interbeds. |
| | Sltstn; dk. gy. |
| | Ss; massive, gy; fine grain |
| | Sltstn; gy. |
| | Sltstn; dk. gy; resistant. |
| | No. 8 Ss; covered. |

SAMPLE

439

Re-SHELL - NORTH- CENTRAL-BLOCK 78(2)A

# STRATIGRAPHIC SECTION

DESIGNATION:

PROJECT: NORTH CENTRAL BLOCK B.C.

AREA: MT. MICHAEL (E)

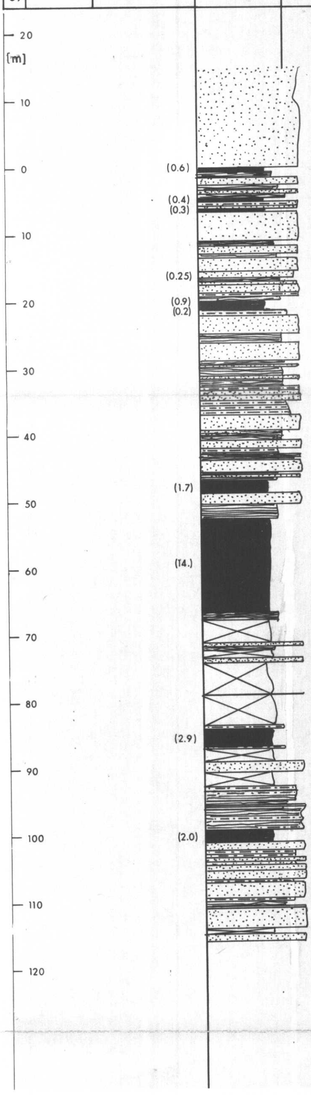
LOCATION: SECTION (20-1) ER-8(A)

PART _____ OF _____

AUTHOR: J. FISHER

DATE: 1979 FEB. 26

SOURCE OF DATA: '




| DESCRIPTION | | SAMPLE |
|---|---|---|
| MAIN | AMPLIFIED | |
| | Ss, massive, medium & fine grain, 12-15 meters | |
| | Coal | |
| | Coaly Shale | |
| | Ss, fine, massive, some Sh. partings, gry. | |
| | Sh. | |
| | Ss, very fine | |
| | Coal & carb. Sh. | |
| | Ss & Sltstn. interbedded | |
| | Coal | |
| | Ss, gry, brown, blocky to massive | |
| | Sh. with some carb. Sh. | |
| | Ss. & Sltstn. interbedded (70% Ss.) | |
| | Carb Sh. | |
| | Ss, massive | |
| | Ss, Sltstn, Sh, interbedded | |
| | Coal | |
| | Ss. | |
| | Ss, massive fine/medium | |
| | Sh. & Sltstn. interbedded | |
| | Coal | |
| | Sltstn. & Sh. (70% Sltstn.) | |
| | Ss, very fine, Sltstn. & occassional Sh. | |
| | Sh. | |
| | Ss, massive & Sltstn, interbedded | |
| | Sh. | |
| | Ss, fine | |
| | Sh. & Sltstn, interbedded | |
| | Ss. (75%) & Sltstn. | |
| | Sh. & Sltstn. | |
| | Ss. & Sltstn. | |
| | Ss, massive gy. | |
| | Sltstn, Sh, Coaly Sh, Ss. | |
| | Sltstn. | |
| | Ss, very fine | |
| | Sltstn. | |
| | Sh. & carb, Sh. | |
| | Ss, very fine | |
| | Sltstn. | |
| | Sh. & carb, Sh. | |
| | Ss, massive | |
| | Sh. | |
| | Coal (0.3 Sh. seam at 54.0m.) | |
| | Sh. & carb, Sh. | |
| | Covered | |
| | Ss, silty gy, Sltstn, gy, Ss, fine grain | |
| | Sh, carb. | |
| | Covered | |
| | Ss, fine grain, gy. | |
| | Covered | |
| | Ss. (0.1m) gy, br. | |
| | Covered | |
| | Sh, silty | |
| | Coal, bright | |
| | Sh. | |
| | Covered | |
| | Ss, fine grain, gy. | |
| | Covered | |
| | Sltstn, (70%) br, some gy carb. shales | |
| | Ss, Sh, Sltstn. interbedded | |
| | Coal, hard, bright | |
| | Ss, gy. | |
| | Sltstn. & Ss. interbedded | |
| | Ss, massive to blocky | |
| | Ss. | |
| | Ss. | |
| | Sltstn. | |
| | Ss, gy. | |
| | Sltstn. | |
| | Sh, carb. | |
| | Ss, br./gy, silty in places | |
| | Covered | |
| | Ss, orange, br, x-bedding | |

HA-15F

439

K-SHELL-NORTH-CENTRAL-BLOCK-78(2)A

# STRATIGRAPHIC SECTION

DESIGNATION:

PART _____ OF _____

PROJECT: NORTH CENTRAL BLOCK B.C.

AUTHOR: J. FISHER

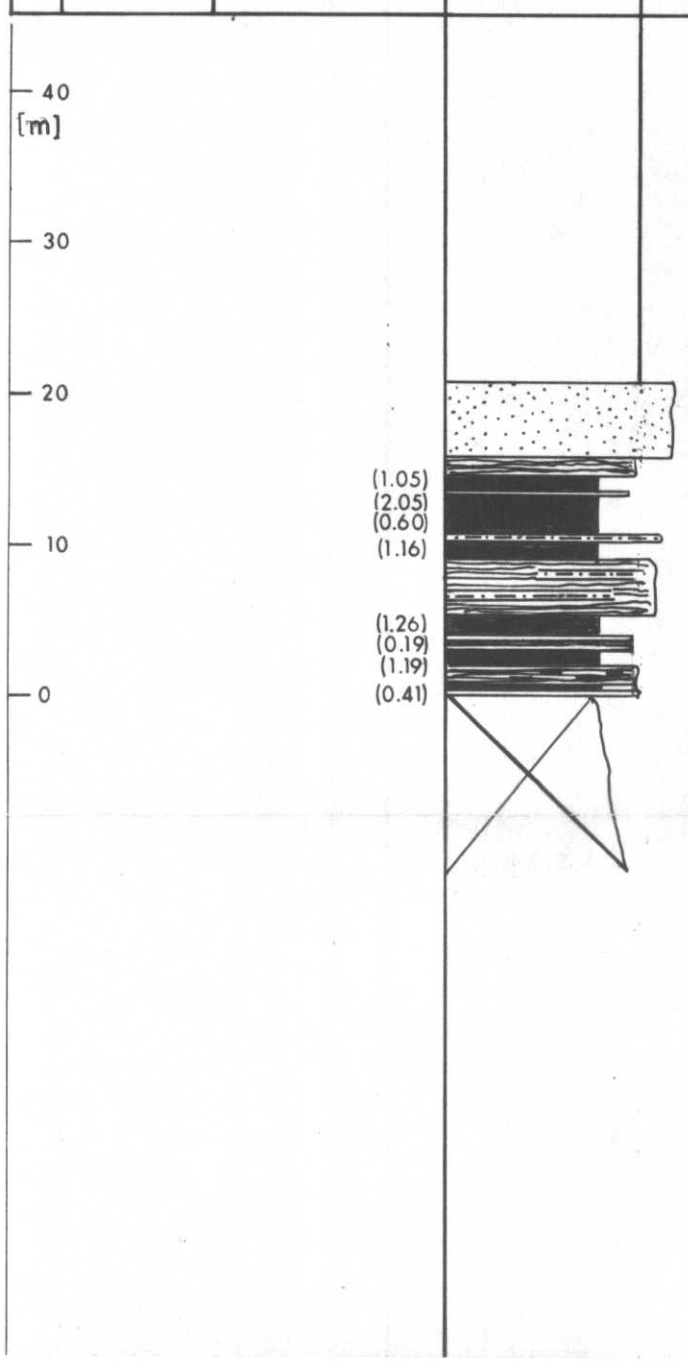
DATE: 1979 MAR. 6

AREA: BANNER MT. (E)

SOURCE OF DATA:

LOCATION: SECTION YH-1

| SCALE | CONTROL POINT | INTERVAL | LITHOLOGY | STRIKE & DIP | DESCRIPTION MAIN | DESCRIPTION AMPLIFIED | SAMPLE |
|---|---|---|---|---|---|---|---|




*Ss, fine grain*

*Sh, grading to Sltstn.*
*Coal, dull*
*Coal*
*Coal, soft, sheared, lower 7 cm blocky*
*Sltstn.*
*Coal, good*
*Sh & Sltstn, black to grey, upper interval fairly thick bedded*
*Coal*
*Shale*
*Coal*
*Shale*
*Coal*
*Sh & Coal*
*Coal*
*Shale, black*
*Covered*

439

MR-7

K
MR-SHELL-NORTH-CENTRAL BLOCK 78(2)A.

# STRATIGRAPHIC SECTION

DESIGNATION:

PROJECT: NORTH CENTRAL BLOCK B.C.

AREA: MT. MICHAEL (EAST)

LOCATION: SECTION (F-1) MR-7

PART _____ OF _____

AUTHOR: J. FISHER

DATE: 1979 FEB. 26

SOURCE OF DATA:

| SCALE | CONTROL POINT | INTERVAL | LITHOLOGY | STRIKE & DIP | DESCRIPTION: MAIN | DESCRIPTION: AMPLIFIED | SAMPLE |
|---|---|---|---|---|---|---|---|
| [m] | | | | | | | |
| 120 | | | | | | Sandstone | |
| 110 | | | | | | Cover | |
| 100 | | 12.5 | | | | Coal, (.2m clay inclusion) | |
| 90 | | | | | | Shale | |
| 80 | | 13.1 | | | | Coal | |
| 70 | | | | | | Shale | |
| | | 2.9 | | | | Coal | |
| | | | | | | Shale | |
| 60 | | 5.6 | | | | Coal | |
| | | | | | | Shale | |
| 50 | | 9.6 | | 326°, 70° W | | Coal | |
| 40 | | | | | | Shale | |
| 30 | | | | | | Sandstone | |
| | | 2.1 | | | | Coal | |
| 20 | | | | | | Sandstone; Moose Mtn. | |
| 10 | | | | | | | |
| 0 | | | | | | | |
| 140 | | | | | | | |
| 150 | | | | | | | |
| 160 | | | | | | | |
| 170 | | | | | | | |
| 180 | | | | | | | |
| 190 | | | | | | | |

439

STRATIGRAPHIC SECTION
NORTH CENTRAL BLOCK
MT MANNING SECTION

| | | | |
|---|---|---|---|
| PROJECT NO. | | DATE | |
| LOCATION | | DRAWN BY | |
| SECTION | | CHECKED BY | |
| DATE | | DATE | |
| DRAWING NO. | | DESCRIPTION | |
| SCALE | | | |

| DEPTH | LITHOLOGY | SPECIAL | SCALE | DESCRIPTION | SAMPLE |
|---|---|---|---|---|---|
| | | | | AMPLIFIED | |

439

# STRATIGRAPHIC SECTION

DESIGNATION: K - SHELL - NORTH - CENTRAL - BLOCK 78(2) A.

PART _____ OF _____

PROJECT: NORTH CENTRAL BLOCK B.C.

AUTHOR: J. FISHER

DATE: 1979 MAR. 10

AREA: MT. MICHAEL (E)

SOURCE OF DATA:

LOCATION: SECTION (11-2) MR-4 (A)

| SCALE | CONTROL POINT | INTERVAL | LITHOLOGY | STRIKE & DIP | DESCRIPTION: MAIN | DESCRIPTION: AMPLIFIED | SAMPLE |
|---|---|---|---|---|---|---|---|
| [m] | | | | | | | |
| 140 | | (4.4) | | | | Coal | |
| | | | | | | Sh, light gy. | |
| | | (3.3) | | | | Coal | |
| | | | | | | Coal, Shaly | |
| | | | | | | Sh, lt. gy, some Sltstn. | |
| 130 | | | | | | Coal & Sh. (carb.) interbedded | |
| | | (0.7) | | | | Coal | |
| | | | | | | Sh, carb, dk. gy. | |
| | | (4.6) | | | | Coal | |
| | | | | | | Sltstn. & some Sh. | |
| | | (0.5) | | | | Coal | |
| 120 | | | | | | Sltstn. & Sh. interbedded | |
| | | (0.8) | | | | Coal & Sh. | |
| | | | | | | Ss. medium grain, light gy, high resist, some shale | |
| | | (0.5) | | | | Coal | |
| | | (0.4) | | | | Sh. with Coal seams | |
| | | (4.3) | | | | Ss. & Sltstn. interbedded | |
| 110 | | | | | | Ss. fine, as below | |
| | | | | | | Ss. fine gy, moderate to high resist. | |
| | | | | | | Coal | |
| | | (0.6) | | | | Coal & carb. Sh. interbedded | |
| | | | | | | Coal | |
| | | | | | | Sltstn. & Sh. interbedded | |
| | | | | | | Coal | |
| | | | | | | Sh. with Coal lenses | |
| | | | | | | Covered | |
| | | | | | | Shaly Coal interbedded with Sltstn. | |
| 100 | | | | | | Coal with some Sh. seams near top | |
| | | (0.5) | | | | Ss with some Sh. seams, Sh. near top | |
| | | | | | | Ss. & Sltstn, blocky | |
| | | (0.3) | | | | Sh. | |
| | | | | | | Coal | |
| | | | | | | Sh. | |
| 90 | | (0.3) | | | | Coal, | |
| | | | | | | Coaly Sh. with coal seams | |
| | | | | | | Coal | |
| | | | | | | Sltstn. light gy, blocky | |
| | | | | | | Ss. as below | |
| | | | | | | Ss. medium grain, gy. | |
| | | | | | | Sltstn. gy, blocky | |
| 80 | | | | | | Sltstn, Ss, Sh, interbedded | |
| | | | | | | Sltstn & Shaly Coal with 0.15 Coal at top | |
| | | | | | | Sh. with 0.2 Coal, Shaly Coal & Coal lenses | |
| | | | | | | Ss, br. moderate resist. | |
| | | | | | | Sh. & Sltstn. interbedded | |
| | | | | | | Sh, Coaly Sh. & Ss. interbedded | |
| | | | | | | Sltstn. & Ss. | |
| 70 | | (1.1) | | | | Ss. fine, gy. | |
| | | | | | | Sh. & Sltstn. interbedded | |
| | | | | | | Sh. & Coal interbedded | |
| | | | | | | Coal with Shaly parts | |
| | | | | | | Sh. Coaly | |
| | | | | | | Sh. & Sltstn. interbedded | |
| | | | | | | Sltstn. & Ss. interbedded | |
| | | | | | | Ss. med. grain, high resistance | |
| 60 | | | | | | Sltstn. & Sh. interbedded | |
| | | | | | | Coal & Sh. | |
| | | (4.8) | | | | Ss. with Sh. lenses, med. grain | |
| | | | | | | Sh. lt. gy, fissile | |
| | | | | | | Coal | |
| 50 | | | | | | Covered | |
| | | | | | | Ss. | |
| | | (2.0) | | | | Coaly Sh, fissile, dk. gy. | |
| | | | | | | Coal | |
| 40 | | (1.0) | | | | Sh. interbedded with Coal | |
| | | | | | | Coal | |
| | | | | | | Sh. gy. | |
| | | | | | | Sh. & Coal interbedded | |
| 30 | | | | | | Covered | |
| 20 | | | | | | Ss. fine, blocky | |
| 10 | | | | | | Ss. gy, coarse to med. grained, high resist. (Moose Mt.) | |
| 0 | | | | | | | |
| 10 | | | | | | | |

439

K

Re-SHELL-NORTH-CENTRAL BLOCK 78(2)A.

# STRATIGRAPHIC SECTION

DESIGNATION:

PROJECT: NORTH CENTRAL BLOCK B.C.

AREA: LINE CREEK

LOCATION: SECTION (F-3) MR-5(A)

PART _____ OF _____

AUTHOR: J. FISHER

DATE: 1978 NOV. 20

SOURCE OF DATA:

| SCALE | CONTROL POINT | INTERVAL | LITHOLOGY | STRIKE & DIP | DESCRIPTION: MAIN | DESCRIPTION: AMPLIFIED | SAMPLE |
|---|---|---|---|---|---|---|---|
| [m] | | | | | | | |
| 270 | | | | | | | |
| 260 | | | | | | | |
| 250 | | 2.1 | | 008, 70 W | Ss., lt. gr. | | |
| | | 0.9 (0.4) | | 358', 72 W | Coal, dull<br>Ss. & Sltstn., lt. gr. | | |
| | | 7.7 | | | Covered in fault zone | | |
| 240 | | 0.5 | | 335, 49 E | Ss., lt. gr. | | |
| | | 0.2 0.9 | | 37 E | Sh. with 0.3 Sltstn. | | |
| | | 0.2 0.3 | | | Sltstn. | | |
| | | 1.8 | | | Sh., carb. with 0.4 Sltstn. | | |
| | | 0.6 0.7 | | | Sh., dk. gr. | | |
| | | 1.0 | | | Ss. with 0.3 Sltstn. | | |
| 230 | | 4.6 | | 026, 47 W | Ss., carb., dk. gr. | | |
| | | 0.5 | | 358, 47 W | Ss., lt. gr., fine grain<br>Ss., Argite, black | | |
| 220 | | 14.9 | | | Covered section, faulted<br>mostly Sh. & Coal<br>pods within section<br>no dip possible | | |
| 210 | | 1.0 1.2 | | | Ss., Argil. | | |
| | | 1.1 | | 85 E | Sltstn., dk. gr. | | |
| | | 1.5 0.6 | | 50 W | Ss., Argil | | |
| | | 2.5 | | | Sh., dk. gr.<br>Coal (0.4) & Sh. (0.2) | | |
| | | 1.8 | | 40 W | Sh., carb., Coal bands | | |
| | | 0.5 0.7 | | | Sh., carb., Festn. inclusion | | |
| 200 | | 0.3 0.5 | | 52 W | Sltstn. & Sh.<br>Ss. above Sh., carb. | | |
| | | 0.3 0.6 | | | Sltstn., light gr. | | |
| | | 1.0 0.4 | | 002, 55 W | Coal above Ss. | | |
| | | 1.0 1.0 | | | Ss., lt. gr. | | |
| | | 0.3 0.4 | | 354, 47 W | Sh., bld. at bottom, carb. at top | | |
| | | 0.6 1.1 | | | Sltstn., lt. gr. | | |
| | | 2.1 | | | Sh., carb. | | |
| 190 | | 1.3 | | | Festn., many modules | | |
| | | 0.6 | | | Sh., dk. gr. at bottom, lt. gr. top | | |
| | | 3.0 | | 354, 55 W | Sltstn., lt. gr. | | |
| | | 0.6 | | | Ss., lt. br., med. grain | | |
| | | 1.0 1.4 | | | Sltstn. | | |
| | | 0.4 0.7 | | | Ss., dk. gr. at bottom, lt. br. at top<br>Sh. | | |
| 180 | | 1.7 | | | Ss. & Sh. interbed. | | |
| | | 1.4 | | | Sltstn. with 0.4 Coal & carb. Sh. | | |
| | | 0.6 1.1 | | | Ss., fine | | |
| | | 1.1 | | | Sltstn. | | |
| | | 1.0 | | 353, 56 W | Sh. & Sltstn. bed (0.6) | | |
| | | 1.2 1.7 | | | Sh. & Festn. (interbed) | | |
| | | 0.5 1.1 | | | Sh. | | |
| 170 | | 0.3 | | | Sltstn. | | |
| | | 2.2 | | | Ss., lt. br., Sh. lam. | | |
| | | 0.9 0.6 | | | Sltstn., lt. br. | | |
| | | 1.4 | | | Ss., lt. br. | | |
| | | 0.2 0.3 | | | Sltstn., lt. gr. | | |
| | | 0.4 0.7 | | | Sh. | | |
| 160 | | 1.2 | | 349, 51 W | Sltstn. | | |
| | | 4.7 | | | Sh., v. carb. | | |
| | | | | | Sltstn., lt. br., gr. | | |
| | | 1.2 0.3 | | | Sh. | | |
| | | 0.9 0.2 | | | Sltstn. | | |
| | | | | | Sh., carb. | | |
| 150 | | 5.2 | | 350, 45 W | Festn., nodular | | |
| | | | | | Ss., lt. gr. | | |
| | | 0.3 | | | Sh., dk. gr. Sh. interbeds | | |
| | | 0.3 | | | Sh., dk. gr., fine, lam., interbed at bottom | | |
| | | | | | Festn. | | |
| | | 6.5 | | | Sh. | | |
| 140 | | | | | Sh., dk. gr., carb. | | |
| | | | | | Ss. | | |
| | | | | | Ss., fine grain, lt. br. | | |
| | | | | | Sh. | | |
| | | 0.4 0.9 | | | Ss. | | |
| | | 1.4 0.2 | | | Sh., lt. gr. | | |
| | | 1.2 0.2 | | | Festn. | | |
| | | 0.7 0.2 | | 351, 54 W | Sh. | | |
| 130 | | | | | Ss., fine grain, lt. br. | | |
| | | | | | Sh. | | |
| | | | | | Ss., med. grain, br. & gy. | | |
| | | | | | Sltstn. | | |
| | | | | | Sh. | | |
| | | | | | Ss., lt. br. top, lt. gr. bottom | | |
| | | | | | Ss., massive | | |
| | | | | | Covered | | |
| | | | | | Ss., massive grey, weathers brown fine | | |
| 120 | | | | | Cover Sltstn./Ss. debris | | |
| | | (9.9) | | | Coal | | |
| 110 | | | | | | | |
| | | | | | Shale & Ss, inter. | | |
| 100 | | (6.1) | | | Coal, dirty | | |
| | | | | | Ss., Coal with Shale interbeds | | |
| | | | | | Covered | | |
| 90 | | | | | Shale | | |
| | | | | | Sltstn, Ss. near top | | |
| | | (2.2) | | | Coal, Shaly in places, dirty | | |
| | | | | | Sltstn with very thin Coal seams | | |
| 80 | | | | | Covered | | |
| | | | | | Sh. with (12m) V. Shaly coal | | |
| 70 | | | | | Ss (90%), Sltstn. inter. some orange/br. concretions | | |
| | | | | | Covered, Sltstn? | | |
| | | (1.0) | | | | | |
| 60 | | (2.7) | | | Coal (dirty, badly weath.), with Shale inter. | | |
| | | | | | Sh, Carb. | | |
| | | (1.1) | | | Coal with Sh. ptg. | | |
| | | (1.5) | | | Sh., sandy, weathers white | | |
| 50 | | | | | Ss. & Sltstn. inter. | | |
| | | | | | Ss. & Sltstn. inter. | | |
| | | | | | Ss., grey massive | | |
| 40 | | | | | Ss., fine grey, weathers br. | | |
| | | | | | Shale with thin Ss. bands, Coal seam | | |
| | | (3.7) | | | Coal, Shaly in places, badly weathered | | |
| | | | | | Covered | | |
| | | (2.5) | | | Coal, Shaly in places, badly weathered. | | |
| 30 | | | | | Siltstone | | |
| | | (3.3) | | | Coal & Shale, - Faulted | | |
| | | | | 350, 35 W | Coal, hard, bright | | |
| | | (1.0) | | | Sltstn, interbedded, Coaly Shale | | |
| | | | | | Coal, v. dirty | | |
| 20 | | (4.9) | | 355, 35 W | Shale, Coaly | | |
| | | | | | Coal, Hard, with small thrust fault. | | |
| | | | | | Interbedded Sltstn. & Coal | | |
| | | | | | Sltstn. | | |
| | | | | | Shale grey | | |
| 10 | | (5.2) | | 5, 55 W | Coal, hard, bright | | |
| | | | | | Sltstn. | | |
| | | | | | Shale, grey | | |
| | | | | | Sltstn. | | |
| 0 | | | | 365, 50 W | Ss, with some interbedded Sltstn. | | |
| | | | | | Moose Mtn. Ss. | | |
| 130 | | | | | | | |
| 140 | | | | | | | |
| 150 | | | | | | | |
| 160 | | | | | | | |
| 170 | | | | | | | |
| 180 | | | | | | | |
| 190 | | | | | | | |
| 200 | | | | | | | |

434

FILE NO. 11A-15N

439

K
~~PB~~-SHELL - NORTH CENTRAL - BLOCK 78(2)A

# STRATIGRAPHIC SECTION

DESIGNATION:

PART _____ OF _____

PROJECT: NORTH CENTRAL BLOCK

AUTHOR: J. FISHER

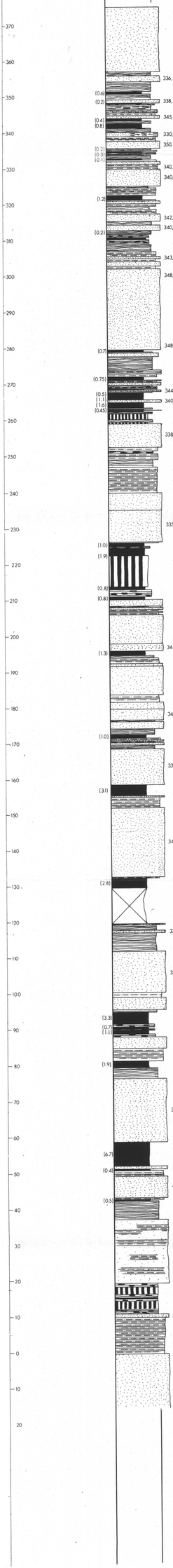
DATE: 1979 APRIL 4

AREA: MT. MICHAEL (W)

SOURCE OF DATA:

LOCATION: SECTION (J-11-1) MR-11

| SCALE | CONTROL POINT | INTERVAL | LITHOLOGY | STRIKE & DIP | DESCRIPTION MAIN | DESCRIPTION AMPLIFIED | SAMPLE |
|---|---|---|---|---|---|---|---|




| Depth (m) | Strike & Dip | Description |
|---|---|---|
| | | Ss, light brown, fine grain, laminar |
| | 336,45W | Shale, silty med grey<br>Ss, laminar, light brown, fine grain |
| | | Shale, black, some carb shale |
| | | Coal bright, hard |
| | 338,50W | Shale, black, silty<br>Ss |
| | | Coal, hard bright |
| | 345,50W | Sltstn<br>Ss |
| | | Shale, coaly, some coal |
| | | Sltstn |
| | 330,45W | Ss |
| | | Coal |
| | 350,50W | Shale grey |
| | | Coal, coaly shale at bottom |
| | | Coal med hard, bright, thinly bedded |
| | | Shale med grey |
| | 340,50W | Ss & sltstn (0.5 sltstn |
| | | Sltstn med grey |
| | 340,45W | Ss light brown, fine grain |
| | | Shale, brown |
| | | Coal |
| | | Shale, grey, some coaly, shale |
| | | Coal |
| | | Ss, light brown, fine grain |
| | | Sltstn & shale interbedded, 0.1 coal near bottom |
| | | Ss, light brown, thinly bedded, fine grain |
| | 342,45W | Shale, coaly, coal at bottom |
| | | Sltstn, grey, some coaly shale |
| | 340,50W | Coal, friable, some coaly shale |
| | | Ss, light brown, fine grain |
| | | Sltstn, grey |
| | | Shale, carb |
| | | Sltstn, med grey, blocky |
| | 343,40W | Ss, fine grain, low resist at top |
| | | Shale, silty |
| | | Ss, fine grain, light grey |
| | 348,52W | Shale, carb |
| | | Coal |
| | | Shale, coaly |
| | | Coal, shaly, 0.3 coal hard, bright |
| | | Shale, coaly |
| | | Shale, med grey |
| | | Sltstn, grey |
| | | Ss |
| | | Sltstn, grey |
| | | Ss, silty, med resistance |
| | | Sltstn, grey |
| | | Ss, fine grain, grading into interbedding sltstn |
| | | Ss, massive, grey, very high resistance |
| | 348,46W | Coal, shaly at top |
| | | Ss & sltstn |
| | | Shale, grey |
| | | Shale & sltstn |
| | | Coal, hard bright |
| | | Ss, fine grain, grey, brown |
| | 344,55W | Coal |
| | | Ss, fine grain, brown |
| | 340,65W | Coal, very hard |
| | | Ss, v fine grain, massive, grey |
| | | Coal, bright hard |
| | | Coal, hard bright |
| | | Carb shale |
| | | Coal, shaly |
| | | Shale, sandy, brown |
| | 338,66W | Coal, shaly |
| | | Ss, fine to very fine grain, thinly bedded, silty in places, grey, weathers brown |
| | | Sltstn, grey |
| | | Shale carb & coaly in places |
| | | Sltstn, grey to brown |
| | | Shale |
| | | Sltstn |
| | | Ss, silty, fine grain, grey, weathers orange-brown |
| | 335,68W | Ss, fine and med grained beds |
| | | Coal, bright crumbled |
| | | Shale, coaly |
| | | Coal, v. hard & bright in places |
| | | Coal, shaly |
| | | Coal, hard, bright |
| | | Shale, coaly |
| | | Coal, crumbled |
| | | Ss, grey, some sltstn near top |
| | | Shale, |
| | | Ss & sltstn interbedded |
| | | Ss, fine grain, grey, weathers brown |
| | 344,65W | Ss, med grain, brown to grey, high res |
| | | Coal, bright hard, some shaly parts |
| | | Shale, some coaly shale |
| | | Sltstn, grey |
| | | Ss, silty ss, interbeds |
| | | Ss, silty, thin ss, interbeds |
| | | Sltstn, grey, brown near base |
| | | Ss, silty, brown |
| | 341,51W | Ss, brown, fine grain |
| | | Shale, silty |
| | | Ss, thinly bedded, grey, fine grain, weathers brown |
| | | Shale, sandy brown |
| | | Coal, crumbled, shaly |
| | | Ss & sltstn interbedded |
| | | Shale, silty, grey |
| | 335,62W | Ss, grey, weathers brown, fine grain, some sltstn interbedded |
| | | Coal, hard, bright, crumbled |
| | | Ss |
| | | Sltstn, sandy, grey, some coal |
| | 342,60W | Ss, fine grain, brown, weathers brown |
| | | Sltstn |
| | | Coal, bright, some shaly coal |
| | | Covered (probably shales & sltstns) |
| | | 0.2 sltstn & 0.2 ss |
| | 335,55W | Shale, silty, grey |
| | | Ss, grey, weathers brown, fine grain |
| | | Shale, silty, some sandy parts |
| | 340,50W | Ss, grey, weathers brown, laminar, silty, (1m) massive orange near bottom |
| | | Sltstn, brown |
| | | Ss, grey, weathers brown, fine grain, few thin sltstn seams |
| | | Shale, grey, silty |
| | | Coal, hard, bright |
| | | Shale, coaly |
| | | Coal, hard, bright |
| | | Shale, coaly |
| | | Ss, laminar, silty near bottom, grey, weathers brown |
| | | Sltstn, grey, 2 thin silty ss. |
| | | Coal, hard, bright |
| | | Shale, silty, dark grey |
| | 347,48W | Ss, grey, weathers brown, interbedded fine & med grain |
| | | Coal, few thin shaly sections, hard, bright |
| | | Ss, v fine grain |
| | | Coal, hard, bright |
| | | Sltstn, brown & sandy at top (0.6m) |
| | -,60W | Ss, grey, weathers brown, fine grain, massive |
| | | Sltstn |
| | | Coal, hard, bright |
| | | Shale, silty, brown |
| | | Ss, & sltstn, sandy, interbedded |
| | | Shale, coaly & coal, shaly, interbedded |
| | 350,55W | Ss, fine grain, grey, weathers |
| | | Sltstn, sandy sltstn, interbedded, dark grey |
| | | Base, ss |

FILE NO. HA-15H

439

K
~~K~~ SHELL - NORTH-CENTRAL BLOCK 78(2)A.

# STRATIGRAPHIC SECTION

DESIGNATION:

PROJECT: NORTH CENTRAL BLOCK B.C.

AREA: MT. MICHAEL (E)

LOGATION: SECTION (17 - 4) MR-4 (B)

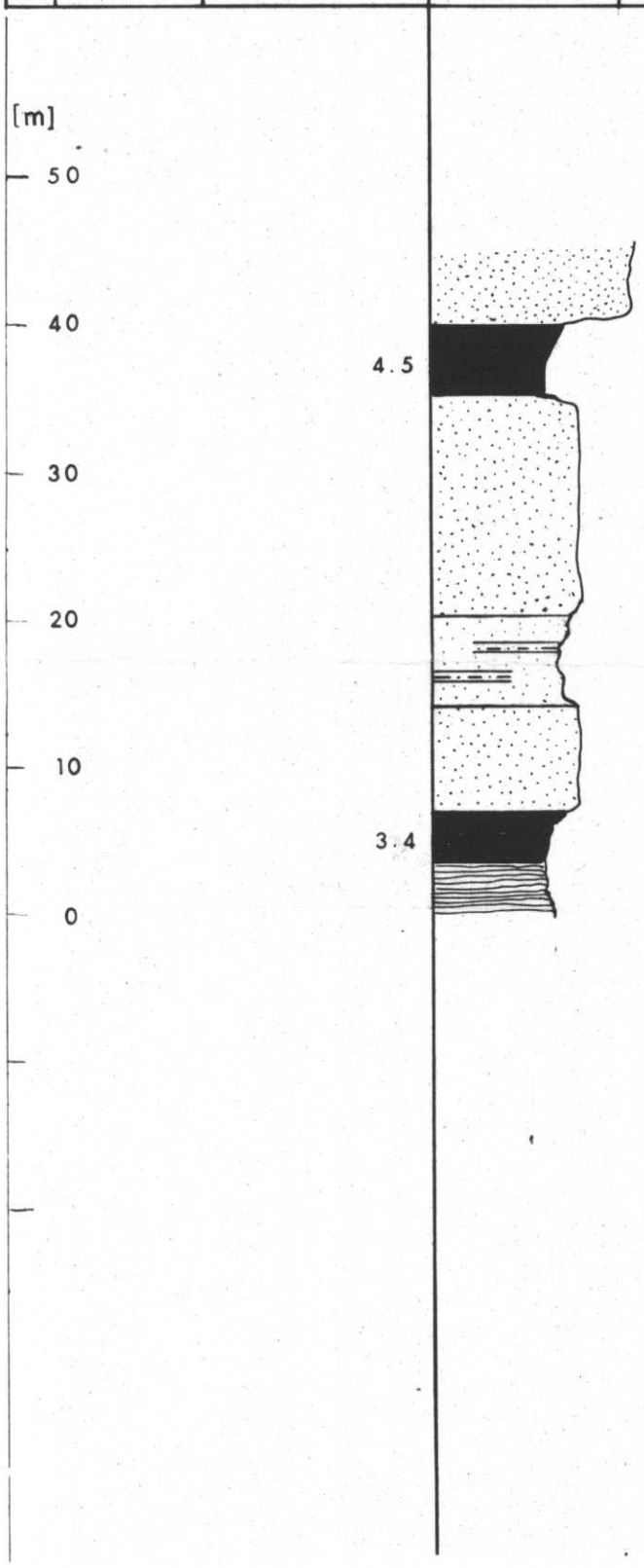
PART _____ OF _____

AUTHOR: J. FISHER

DATE: 1978 NOV. 20

SOURCE OF DATA:

| SCALE | CONTROL POINT | INTERVAL | LITHOLOGY | STRIKE & DIP | DESCRIPTION | | SAMPLE |
|---|---|---|---|---|---|---|---|
| | | | | | MAIN | AMPLIFIED | |




Sandstone

Coal

Sandstone : massive , faulting

Sandstone & Siltstone

Sandstone massive

Coal , Shaly
Shale , Sandstone interbeds.

FILE No. H.

439

# STRATIGRAPHIC SECTION

DESIGNATION: K RR-SHELL - NORTH- CENTRAL BLOCK 78(2)A.

PART _____ OF _____

PROJECT: NORTH CENTRAL BLOCK B.C.

AUTHOR: J. FISHER

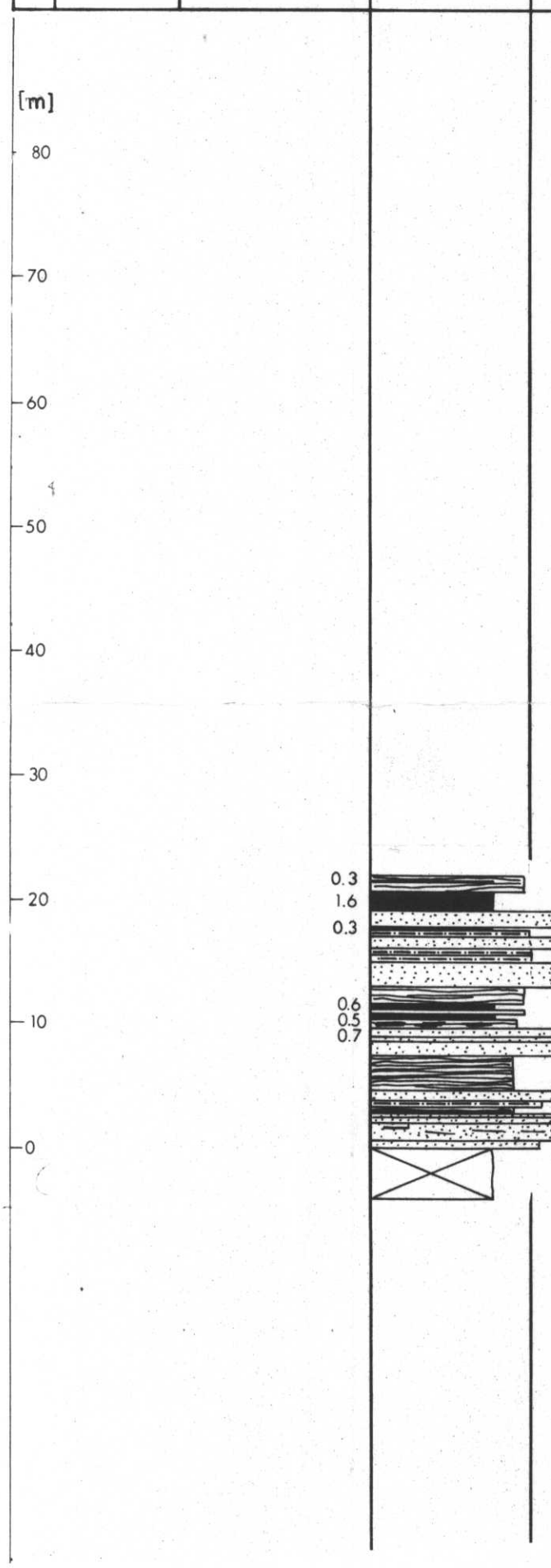
DATE: 1979 APRIL 4

AREA: MT. MICHAEL (E)

SOURCE OF DATA:

LOCATION: SECTION (9-1) MG-7(A)

| SCALE | CONTROL POINT | INTERVAL | LITHOLOGY | STRIKE & DIP | DESCRIPTION: MAIN | DESCRIPTION: AMPLIFIED | SAMPLE |
|---|---|---|---|---|---|---|---|
| [m] | | | | | | | |




FILE No. HA-15P

439

K
~~K~~-SHELL-NORTH-CENTRAL-BLOCK 78(2)A

# STRATIGRAPHIC SECTION

DESIGNATION:

PART _____ OF _____

PROJECT: NORTH CENTRAL BLOCK B.C.

AUTHOR: J. FISHER

DATE: 1978 NOV. 20

AREA: MT. MICHAEL (E)

SOURCE OF DATA:

LOCATION: SECTION (13-2) MR-8

| SCALE | CONTROL POINT | INTERVAL | LITHOLOGY | STRIKE & DIP | DESCRIPTION | | SAMPLE |
|---|---|---|---|---|---|---|---|
| | | | | | MAIN | AMPLIFIED | |
| [m] | | | | | | | |
| 20 | | | | | | | |
| | | | | | | Sandstone, very fine, some Sltstn. Shale, some Coal | |
| | | 2.2 | | | | | |
| 10 | | | | | | Shale, some Coal | |
| | | 10.5 | | | | | |
| 0 | | | | | | Sandstone: massive med. grn. | |

FILE No. 1-1A-15E

439

# STRATIGRAPHIC SECTION

DESIGNATION: SHELL - NORTH - CENTRAL - BLOCK 78(2)A.

PART _____ OF _____

PROJECT: NORTH CENTRAL BLOCK B.C.

AUTHOR: J. FISHER

DATE: 1979 FEB. 22

AREA:

SOURCE OF DATA:

LOCATION: SECTION (16-1) MG-6

| SCALE | CONTROL POINT | INTERVAL | LITHOLOGY | STRIKE & DIP | DESCRIPTION: MAIN | DESCRIPTION: AMPLIFIED | SAMPLE |
|---|---|---|---|---|---|---|---|
| [m] | | | | | | | |
| 100 | | | | | | Coal, soft, some hard lenses | |
| 90 | | 18.1 | | | | Coal, bottom hard | |
| 80 | | | | | | Covered | |
| | | | | | | Ss. | |
| | | | | | | Ss. | |
| | | | | | | Sh. | |
| | | | | | | Sltstn. | |
| | | | | | | Sh. | |
| 70 | | | | | | Sh., carb. | |
| | | 0.3 | | | | Ss., Sh. interbeds | |
| | | 1.4 | | | | Sh. | |
| | | | | | | Coal | |
| | | | | | | Sh., carb. | |
| | | | | | | Coal, very soft | |
| 60 | | | | | | Ss., lt. br. | |
| | | | | | | Sh. | |
| | | | | | | Sh., carb. | |
| | | | | | | Sh., br., friable | |
| | | 0.6 | | | | Ss., br., Sh. interbedded | |
| | | | | | | Sh., dk. gy. | |
| | | | | | | Sh., carb. | |
| | | | | | | Coal, very soft | |
| 50 | | | | | | Sh., Coaly, small Coal lenses | |
| | | | | | | Sh., lt. br. | |
| | | | | | | Sh., Coaly | |
| | | | | | | Ss., lt. br., med. grain | |
| | | | | | | Sh., dk. gy. | |
| | | | | | | Sh., carb. | |
| | | | | | | Sh., carb., Festn. band | |
| 40 | | | | | | Ss., lt. br., fine grain | |
| | | | | | | Sh., carb. | |
| | | | | | | Sh., lam. | |
| | | | | | | Sh, dk. gy. | |
| | | | | | | Sh., slightly carb. | |
| | | | | | | Festn. | |
| | | | | | | Sh., carb., with 0.1 Coal | |
| | | | | | | Ss. as below | |
| 30 | | | | | | Ss., lt. br., thin Shale interbeds | |
| | | | | | | Sh. & Sltstn., slightly carb. | |
| | | | | | | Sh., carb. | |
| 20 | | 0.6 | | | | Coal, bright, hard, shattered | |
| | | | | | | Sh., carb. | |
| | | | | | | Ss., lt. gy. to br., Sh. interbed | |
| | | | | | | Ss., Sh. interbedded | |
| 10 | | | | | | Ss., lt. br. | |
| | | | | | | Sltstn., gy., minor Sh. (carb.) | |
| | | | | | | Ss., Sltstn. interbedded | |
| | | | | | | Ss. as below, with minor Festn. band | |
| | | | | | | Ss. as below, & Sltstn. stringers | |
| | | | | | | Ss., fine grain, lt. br., weathered | |
| 0 | | | | | | Ss., lt. gy., weathered, med. to fine grain | |

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# STRATIGRAPHIC SECTION

DESIGNATION: K - SHELL - NORTH - CENTRAL - BLOCK 78(2)A. | PART _____ OF _____

PROJECT: NORTH CENTRAL BLOCK B.C.

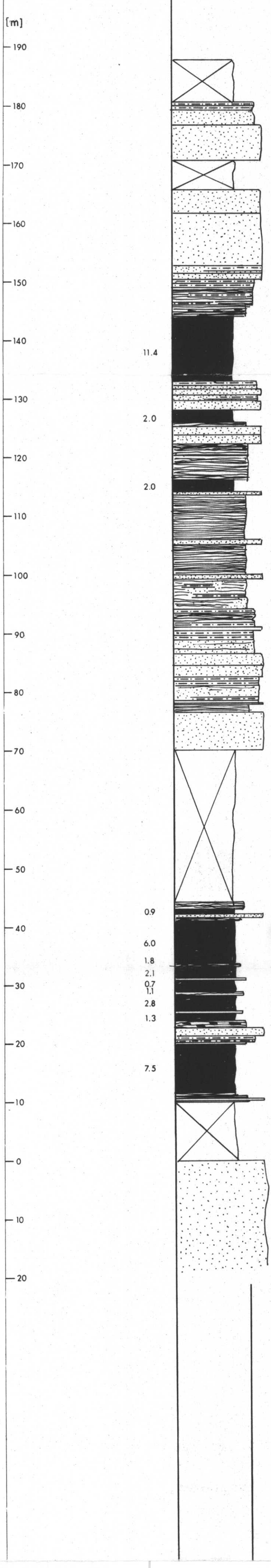
AUTHOR: J. FISHER | DATE: 1979 MAR. 19

AREA: MT. MICHAEL (EAST)

LOCATION: SECTION (7-3) MG-7(B)

SOURCE OF DATA:

| SCALE | CONTROL POINT | INTERVAL | LITHOLOGY | STRIKE & DIP | DESCRIPTION: MAIN | DESCRIPTION: AMPLIFIED | SAMPLE |
|---|---|---|---|---|---|---|---|




*Covered (to road)*

*Sltstn. & Ss. (fine)*

*Ss., fine to med., high resist., massive, lt. br. - gy.*

*Covered (Shale showing)*

*Ss., fine, mod. resist.*

*Ss., fine to med., massive, high resist., Siltier near top*

*Ss., fine & Sltstn.*
*Ss., massive, mod. to high resist.*
*Sltstn. & Sh., med. gy.*

*Sh., Coal lenses, dk. gy.*

*Coal*

*Ss. & Sltstn.*
*Ss., massive*
*Ss. & Sltstn., blocky*
*Ss., fine, massive, Sh. (0.2) at bottom*
*Coal, numerous Sltstn. lenses up to 0.05 thick*
*Sh., dk. carb.*
*Ss., massive*
*Ss., fine, blocky*
*Ss., fine, massive, lt. gy.*
*Sh., dk. gy., carbonate*
*Coaly, at 4.5 0.3m Coal*

*Coal (0.1m Sh. banel near top)*
*Ss., fine*

*Sh.*

*Ss., fine, massive*

*Sh.*

*Ss., fine, lt. gy.*

*Sh. (dominant) & Ss. & Sltstn. intervals, dk. gy., mud - low resist.*

*Sltstn., Ss., Sh., Fissile*

*Ss., v. fine, high resist.*
*Sltstn. & v. fine Ss., Fissile, Sh. intervals*

*Ss., fine, massive, high resist.*

*Ss., med. gy.*

*Sltstn. & Ss., fine, Shaley intervals, mod. resist.*
*Ss., fine*
*Sh., fissile, med. gy.*

*Ss., fine, massive, high resist., lt. gy., weathers br.*

*Covered, approx. measured (25m)*

*Sh., Silty*
*Coal, hard, bright*
*Ss., Silty*
*Shaly Coal*
*Coal, very hard, bright.*

*Coal, hard, bright*
*Shaly Coal*
*Coal, hard, bright*
*Coaly, Sh. (0.1)*
*Coal*
*Coal as below*
*Sh.*
*Coal as below*
*Sh. carb.*
*Coal, very hard, bright when fresh*
*Sh., gy., interbed with carb. & Coaly Sh.*
*Ss., very fine, silty*
*Sh.*
*Sltstn., gy.*
*Sh. Coaly & carb.*
*Coal, very hard, bright*

*Covered*
*Ss., med. to fine*
*Sh., gy.*

*Covered*

*Moose Mtn. - Ss.*