K- VINCENT OPTION 70(1) A

~~File 6257-d~~

N.T.S. 82-J-6, 7, 10, 11

VINCENT OPTION
UPPER ELK VALLEY, BRITISH COLUMBIA
GEOLOGICAL REPORT

January 20, 1971
Toronto, Ontario.

Rolands A. Benkis
Robert C. Hart

PLATE 1

Elk Valley (looking S.E.). Elk Range in background, Front Range at right. Elevated tree covered area at right represents Kootenay Formation, depressed area in centre of photo is underlain by Fernie Group.

GEOLOGICAL REPORT

VINCENT OPTION

UPPER ELK VALLEY, BRITISH COLUMBIA

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SUMMARY

A program of geological mapping and prospecting on a coal property owned by C. Vincent Construction Ltd. in the Upper Elk Valley, located certain coal occurrences. Steep structural dips and unfavourable topography over most of the property make the mining potential of this prospect doubtful. However, the possibility cannot be ruled out that additional studies, concentrated on the northwestern portion of the property, might disclose an area with mine-making potential.

ACKNOWLEDGEMENT

This report is the result of work done by a group of individuals with common interests in geology, under the able supervision of Owen Cullingham. Cullingham's report summarizing the summer's activities has been quoted liberally in this presentation. B. Coulter and R. A. Chaudhry made excellent contributions in their role as leaders of mapping parties; they were assisted greatly by junior student assistants. Everyone involved in this project is most grateful to Mr. W. J. Hennessey of Calgary whose experience and guidance did much to make this project a success. Garry Forman and Dirk Havler of Alpine Helicopters Ltd. must be complimented for their virtuosity in piloting a helicopter as they made our work easier and less time consuming.

GEOLOGICAL REPORT

VINCENT OPTION

UPPER ELK VALLEY, BRITISH COLUMBIA

N.T.S. 82-J-6,7,10,11

INTRODUCTION

General Statement

During the early part of 1970, Rio Tinto Canadian Exploration Limited signed an agreement with C. Vincent Construction Ltd. of Dawson Creek, British Columbia, to option certain coal lands held by the company in upper Elk Valley near the British Columbia - Alberta provincial boundary. Geological mapping and prospecting for coal was carried out over the property during the month of June and part of July; this report presents the results of this work.

Property

When first optioned, the property comprised 9,256 acres held under 19 coal licences; last July, before our crews left the area, seven additional coal licences were staked covering 3,680 acres:

COAL LICENCE	LOT NO.	ACRES
C.L. 572	L. 8477	640
C.L. 573	L. 8479	320
C.L. 574	L. 8480	640
C.L. 575	L. 8481	640
C.L. 576	L. 8482	640
C.L. 577	L. 8483	640
C.L. 578	L. 8484	320
C.L. 579	L. 8485	640
C.L. 580	L. 8486	640
C.L. 581	L. 8487	320
C.L. 582	L. 8488	320
C.L. 583	L. 8489	640
C.L. 584	L. 8490	592
C.L. 585	L. 8491	233

COAL LICENCE	LOT NO.	ACRES
C.L. 586	L.8492	12
C.L. 587	L.8493	129
C.L. 798	Unsurveyed	640
C.L. 799	Unsurveyed	610
C.L. 800	Unsurveyed	640
C.L. 1012	Unsurveyed	320
C.L. 1013	Unsurveyed	640
C.L. 1014	Unsurveyed	640
C.L. 1015	Unsurveyed	640
C.L. 1016	Unsurveyed	640
C.L. 1017	Unsurveyed	640
C.L. 1018	Unsurveyed	160
	TOTAL	12,936 acres

Location and Accessibility

The Vincent property lies in the Upper Elk Valley on the British Columbia side of the Alberta-British Columbia provincial boundary. It is some 55 air miles and 85 road miles southwest of Calgary, Alberta and 55 miles north of Sparwood, B. C. Geographically, the centre of the Vincent property is at:

50° 30' north latitude
115° 00' west longitude
N.T.S.: 82-J-6,7,10,11

Access to the property is via the Elk Pass road which is maintained by Calgary Power Limited to service their transmission line crossing the property. The road is in dismal condition and at best should be negotiated only by four-wheel drive vehicle. During the spring break-up in May and June it is impassable. The Elk Pass Road connects Kananaskis Highway to the north of Vincent property with Sparwood to the south. Recently,

the B.C. Forest Service constructed a new road on the west bank of Elk River which provides reasonably good access to part of the Upper Elk Valley; the new road joins the Elk Pass road approximately five miles south of the property.

Presently, the nearest railroad is C.P. rail line under construction to the mine site of Fording Coal Ltd.; the new line leaves Elk Valley and enters Fording River Valley approximately 40 miles south of our claims. It is expected that another rail line will be constructed northwards to Weary Ridge in Emkay-Scurry property, nine miles south of the Vincent property.

A Calgary Power Ltd. high-voltage transmission line (132,000 volts) crosses the entire length of the Vincent property. The line transmits power from the Elko plant south of Fernie, B.C. to as far north as Edmonton, Alberta.

Topography

The Upper Elk Valley is a narrow, north-south situated, depression between the Elk Range to the east and the Front Range of Rocky Mountains to the west (Plates 1 & 2). The elevations in both ranges reach 9,000 $\pm$ feet above sea level whereas the highest point in the valley is on Elk Pass near the provincial boundary at 6,700 feet. The valley floor drops towards the south and at the south end of the property the elevation is 5,300 feet above sea level.

The Elk River, flowing out of Elk Lakes near the

northern end of the property, winds its way down the valley along the length of the Vincent property and carries considerable volume of water for the better part of the year. A number of creeks enter Elk River off both mountain ranges, but as these streams carry mostly spring run-off water they are dry during most of the year. The south end of the property is crossed by Cadorna Creek, a major tributary of Elk River from the west and which, similar to the Elk River, also carries considerable volume of water for most of the year.

The valley floor lies under a thick cover of gravel and till, and rock outcrops are sparse. The vegetation cover is mostly second growth, spruce and balsam. Forest fires during the 1930's destroyed vegetation in upper Elk Valley and left numerous upright dead trees or "snags", which make helicopter landings difficult or impossible.

Previous Work

Very little is known regarding coal exploration in the Upper Elk Valley prior to the mapping and prospecting by Rio Tinto Canadian Exploration Limited last summer. Geological Survey of Canada Memoir 53 (Dowling,pp. 74) reports analyses of three coal samples, apparently taken from seams near Elk Lakes at the northern end of Elk Valley; the memoir was published in 1914 and thus indicates some investigations during the early part of this century. During the course of our mapping, several old coal adit sites were

discovered in the southern part of C.L. 576 and on the east side of C.L. 579. The physical appearance of these workings suggest that they also date back to the early 1900's.

In the summer of 1969, Rio Tinto Canadian Exploration Geologists mapped certain coal lands north of the Vincent property on the Alberta side of the provincial boundary. During the course of this work, a reconnaissance survey was made of the Upper Elk Valley between Elk Pass and Weary Ridge. Several positive and possible coal occurrences which were found on the Elk Pass Road and on Tobermory Hill between Tobermory Creek and the road near the north end of the property, contributed to the subsequent optioning of the property.

Other known geological investigations in the general area have been at Weary Ridge, approximately six miles south of the confluence of Cadorna Creek and Elk River on a property now being readied for production by EmKay-Scurry Ltd.

During the past two summers Rio Tinto Canadian Exploration Limited has been exploring a coal property north of the Vincent property on the Alberta side of the provincial boundary.

FIELD WORK

The first attempt to enter the Elk Valley was by R. A. Benkis and R. A. Chaudhry on May 2nd. It was an abortive scouting trip because deep snow on the Elk Pass Road forced us back at a point some 45 miles north of Sparwood.

It had been intended to start the field season late in May; although the first trip into Elk Valley was made on May 22, it was June 6 before work could get underway. Poor ground conditions during spring thaw made entering the valley difficult (Plates 5 & 6) and caused delays in establishing a camp. Camp trailers being towed to the property became stuck in the mud and it was necessary to bring in a bulldozer from Sparwood to tow the trailers the last four miles to the selected camp site.

The field work was done by four two-man parties flown into the field daily by a helicopter or driven to work in four-wheel drive vehicles. The aircraft, a Bell 47G3B-1 model equipped with supercharger for high altitude operations, was under charter to Rio from Alpine Helicopters Ltd. of Calgary. The availability of a helicopter contributed to rapid coverage of the property. Our parties left Elk Valley on July 8.

The mapping was done by traversing across the formations in search of outcrop, mainly along stream beds. Dead fall timber from forest fires in the 1930's covered the ground almost everywhere and made walking difficult and hazardous, particularly during wet periods. The information gathered in the field was plotted on overlays of air photos to the scale of 4" = 1 mile and later transferred to a base map of the same scale. The base map

was a blow-up of 1:50,000 scale maps of the National Topographic Series. Where indications of coal were found, attempts were made to locate and explore the concealed seams through trenching by hand. These attempts were not always successful because of a heavy cover of drift in the valley.

The crews were housed in industrial trailers leased from ATCO (Western) Ltd. in Calgary; catering service was provided by Classic Catering Ltd. of Calgary.

GEOLOGY

General Geology

Rocks ranging in age from Palaeozoic to Lower Cretaceous underlie the Vincent property; however, the major lithological unit encountered on the property is the Kootenay formation of Jurassic-Cretaceous age. This formation consists of a sequence of shale, conglomerate and non-marine sandstone beds. The coking coal deposits of southeastern British Columbia and southern Alberta all occur in the Kootenay formation. It is typical of the beds that they generally do not outcrop well but become converted to soil easily and are hidden under dense vegetation (Plate 3).

The topography of Upper Elk Valley closely relates to

its geology. The bordering mountain ranges are formed by competent Palaeozoic carbonates which have been thrust upon and now overlie the much softer Mesozoic sediments. Along the west side of the valley, Palaeozoic formations have been thrust along Borgeau Thrust upon Kootenay beds which occupy a lower topographical position. The Kootenay, in turn, overlies the soft shales of the Fernie group at the bottom of the valley; over most of its way the course of the Elk River has been confined to the Fernie. Along the east side of the valley the topography is rising again, passing through progressively harder formations of Mesozoic and Palaeozoic age.

The Laramide orogeny at the beginning Eocene time elevated the Rocky Mountains and resulted in tectonic deformation of sediments of the preceding eras, particularly of the coal-bearing Kootenay beds.

Stratigraphy

No attempt will be made to give a detailed description of the stratigraphic column; instead, only formations on, or near the Vincent property will be considered. Lower Mesozoic and Palaeozoic rocks will be considered as an undivided unit.

TABLE OF FORMATIONS

Era	Period of Epoch	Group or Formation	Lithology	Thickness in Feet
Cenozoic	Quaternary		Gravel, soil, till	
	U N C O N F O R M I T Y			
Mesozoic	Lower Cretaceous	Elk Formation	Conglomerate, sandstone, shale minor coal. Deltaic.	900±
	Lower Cretaceous-Jurassic	Kootenay Formation	Coarse and fine grained sandstone, conglomerate, conglomeritic sandstone, siltstone, shale, COAL. Non-marine.	2000±
	Jurassic	Fernie Group	Black shale, interbeds of siltstone and silty shale. Marine.	750±
	D I S C O N F O R M I T Y			
	Triassic	Spray River Formation	Siltstone & silty shale. Marine.	1000±
	D I S C O N F O R M I T Y			
Palaeozoic			Carbonate rocks, limestone, dolomite calcareous shale, etc. Mostly Marine.	

Palaeozoic

Lower Mesozoic-Palaeozoic formations form the mountains of Elk Range east of the Vincent property and Eastern Frontal Range of the Rocky Mountains along the west side of the ground. The formations consist of limestone, calcareous shales and dolomitic rocks.

Spray River Formations

The rocks of the Triassic Spray River formation outcrop east of the Vincent property along the west flank of Elk Range.

The Spray River formation is in an erosional contact with the underlying Palaeozoic formations. The estimated thickness of this formation in Upper Elk Valley is 1,000 $\pm$ feet. The formation is decreasing in thickness from west towards the east; near Banff its thickness is approximately 1,800 feet whereas along the west flank of Highwood Range it is estimated to be only 200 to 400 feet thick.

The Spray River rocks are moderately competent, thin bedded, grey to dark grey siltstones, silty shales and white quartzose sandstones.

Fernie Group

The Fernie Group underlies a strip of ground along the east side of the property. Being the most recessive formation in the area the Fernie occupies topographically lowest positions of upper Elk Valley and outcrops only rarely.

The Fernie rocks are in disconformable contact with the Spray River formation. The thickness of the Fernie strata in the Highwood area is known to be approximately 700 feet; as the Fernie sediments thicken towards the west in Upper Elk Valley their thickness is in excess of 700 feet.

Kootenay Formation

At least two thirds of the total acreage of the Vincent property is underlain by Kootenay formation which occupies the area between Borgeau thrust fault and the ground underlain by Fernie Group.

The bulk of the Kootenay formation consits of medium grey, silty shales, siltstones, very fine to medium grained argillaceous sandstones and coal seams. Conglomerate lenses appear throughout the formation but become more extensive, and the size of the pebbles increases, towards the top of the sequence. All units are lenticular and laterally grade into one another making correlation difficult. The formation lacks a definite marker horizon.

The contact between the Kootenay formation and the Fernie group is gradational and is arbitrarily placed at the base of a massive bedded, fine to medium grained sandstone unit. This basal-sandstone unit is commonly medium to dark grey with "salt and pepper" texture, but in the Upper Elk Valley it has a medium light olive color; it weathers to a medium brown-grey color and becomes iron stained. The thickness of the basal-sandstone is 40 to 150 feet. The thickness of the Kootenay formation in Upper Elk Valley

is estimated at 1,200 to 2,000 feet; repetition through thrust faulting render an accurate measurement of the true thickness impossible. Generally the thickness of the formation varies considerably from area to area but on the whole the formation thickens from the east towards the west.

With the exception of the basal-sandstone member, all Kootenay beds are commonly of non-marine origin.

Elk Formation

The Elk formation overlies conformably the Kootenay formation. It occurs in the Elk Valley as far north as Lower Elk Lake; the absence of the formation further north might be explained by lateral facies change, pre-Blairmore erosion or having been cut off by the Borgeau thrust fault. At its maximum development in the southern regions of Elk Valley the formation attains a thickness of approximately 1,700 feet whereas in the Upper Elk Valley it is estimated to be some 900 feet thick. On the Vincent property the Elk formation underlies the northwestern corner near Lower Elk Lake, and again an area near the southeastern third of the property.

The Elk formation consists of resistant, commonly ridge forming, chert pebble conglomerate interbedded with medium to light grey, fine to coarse grained sandstone with gradational contacts. The formation weathers to a light grey color with iron staining. Commonly the pebble diameter is 4 to 40 mm; the size decreases towards the north. The matrix of the conglomerate is siliceous, fine to coarse grainded sandstone; it fractures through the matrix

rather than the pebbles which distinguishes it from the Blairmore (Cadomin) conglomerate.

The Elk formation represents a deltaic depositional environment.

Quaternary

The Quaternary is represented by a considerable cover of unconsolidated river deposits and glacial debris, such as gravel, till, clay, etc.

Structural Geology

The Kootenay formation in the Upper Elk Valley lies in the Lewis Thrust Plate and generally strikes 330° to 350° although local variations in the strike are common. The lower contact of the Kootenay formation is exposed in several locations on the Vincent property, where it is seen in conformable contact with Fernie group. The upper contact of the Kootenay is lost under the Borgeau thrust in the areas where the Elk formation is absent.

For the most part, the structure in the area under study is relatively simple; this may be more apparent than real because the drift covering the valley floor makes outcrop information sporadic. Folding is apparent in the area; a southwards plunging major syncline and anticline follow the length of the property. Thrust faulting and minor folding are also present and had more outcrop information been available, probably would account for a more complex structural picture than the one presented in this report. The structural dips in the area are mainly SW although

NE dips were also located; the magnitude of the dips vary between 35° and 85° with the average being approximately 60°. The steeper dips generally occur in the upper Kootenay on the southwest side of the valley whereas the more gentle dips are prevalent in lower Kootenay along the northeastern side of the property.

At Elk Pass near the B.C.-Alberta boundary, thrust faulting appears the major structural element complicating the geological setting. Folding is also apparent and could have a profound effect on the structural picture. The strata here dip 25° to 50° SW with the average dip on Tobermory Hill being somewhat less than 40° SW. Dips towards NE are also encountered. The absence of good marker horizons in the Kootenay formation as well as the interfingering relationship of individual beds make a structural analysis of the area difficult.

Seven cross sections have been constructed (DWG.G-3352) to present the structural interpretation for the Vincent property. The dotted lines are structural lines rather than traced horizons; however, lithology was taken into consideration in placing the structure lines.

Sections 1-1' and 7-7':

There is evidence of folding in the upper, and of thrust faulting, in the lower Kootenay. A syncline is suspected beneath the overburden east of Lower Elk Lake.

Two coal horizons exist in this part of the property which are believed to be a repetition of the same horizon through thrust faulting.

Section 2-2':

The evidence of folding in the lower Kootenay and a small thrust fault near the Kootenay-Elk contact do not adequately account for the 4000 foot thickness of the Kootenay in the section. It must be assumed that additional faulting and/or folding has gone undetected. Evidence of coal was found in the drift near the section line, but the thickness of the cover defeated the attempt to expose bedrock.

Section 3-3'

Thrust faulting in upper Kootenay and evidence of folding elsewhere in the sequence partially explain the total mapped thickness of Kootenay strata; however, at least another thrust fault or additional folding is required to explain the apparent thickness.

Coal wash was found along the line of section, but no bedrock could be located. A 3-foot coal seam, believed to represent a similar stratigraphical horizon, was found some 700 feet northwest of the section line.

Section 4-4':

Evidence of folding in this area was found in the lower part of the Kootenay. To account for the apparent thickness of the Kootenay strata it must be assumed that a syncline in the southwestern half of the section, well developed in sections 5-5' and 6-6', has gone undetected beneath the overburden. Coal wash and two old adits were found along the line of section. Where bedrock could be exposed, a few coal seams were found, one approximately 8 feet thick.

Coal was also found approximately half way between sections 3-3' and 4-4'; it would appear to be in the same horizon as coal in section 4-4'.

Section 5-5':

A well developed syncline is present east of Borgeau thrust. Between the syncline and the fault, additional complex folding has occurred. Northeast of the syncline are some minor folds giving an apparent thickness of the Kootenay in excess of 2,000 feet.

Coal wash was found in the section but overburden prevented locating the source. It is possible that coal here lies in the same horizon as coal in section 4-4'.

Section 6-6':

As presented in this section, the Kootenay formation northeast of the syncline at the centre of the section line has an apparent thickness of 2,500 feet. To reduce this to the estimated thickness of 1,200 to 2,000 feet, thrust faulting or tight folding must exist in the area northeast of the syncline. No evidence to support such an assumption was found in the field.

Coal

Coal sufficiently interesting to warrant further consideration was found in the area immediately south of British Columbia-Alberta boundary. It does not mean that coal in similar quantities does not exist elsewhere on the Vincent property; overburden may have prevented us from finding it. However, interpretation of the structural information presently available nowhere indicates that a situation favourable for open-cut or underground mining might exist on the Vincent property beyond the height of land at Elk Pass. Considering this, an expensive exploration programme, which would be necessary because of the thick overburden, does not appear to be warranted.

Along the west flank of Tobermory Hill, a chance exists that some open-cut mining might be possible. The formations dip in the same direction as the topography; although the dips are steeper than the hill slope, additional work here could possibly outline a limited area for mining of coal.

RECOMMENDATIONS

No additional field work is recommended for the present. The assembled geological data should be analyzed further, with an emphasis on the Tobermory Hill area. Should the office work suggest that the area warrants more attention, the next step in the field will have to be a diamond drill programme supplemented by bulldozer trenching on the southwest flank of Tobermory Hill.

January, 1971

Rolands A. Benkis

Robert C. Hart

PROFESSIONAL ENGINEER
PROVINCE OF BRITISH COLUMBIA
R. C. HART

Expiry Date: Mar. 3, 1972

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PLATE 2

Elk Valley (looking NW). Cadorna Creek Valley in left-central part of photo. Note the sharp contact between vegetation-covered Mesozoic sediments and barren Palaeozoic carbonates.

PLATE 3

Camp in Elk Valley (looking NW). Elk Pass and Tobermory Hill in upper-central part of photo.

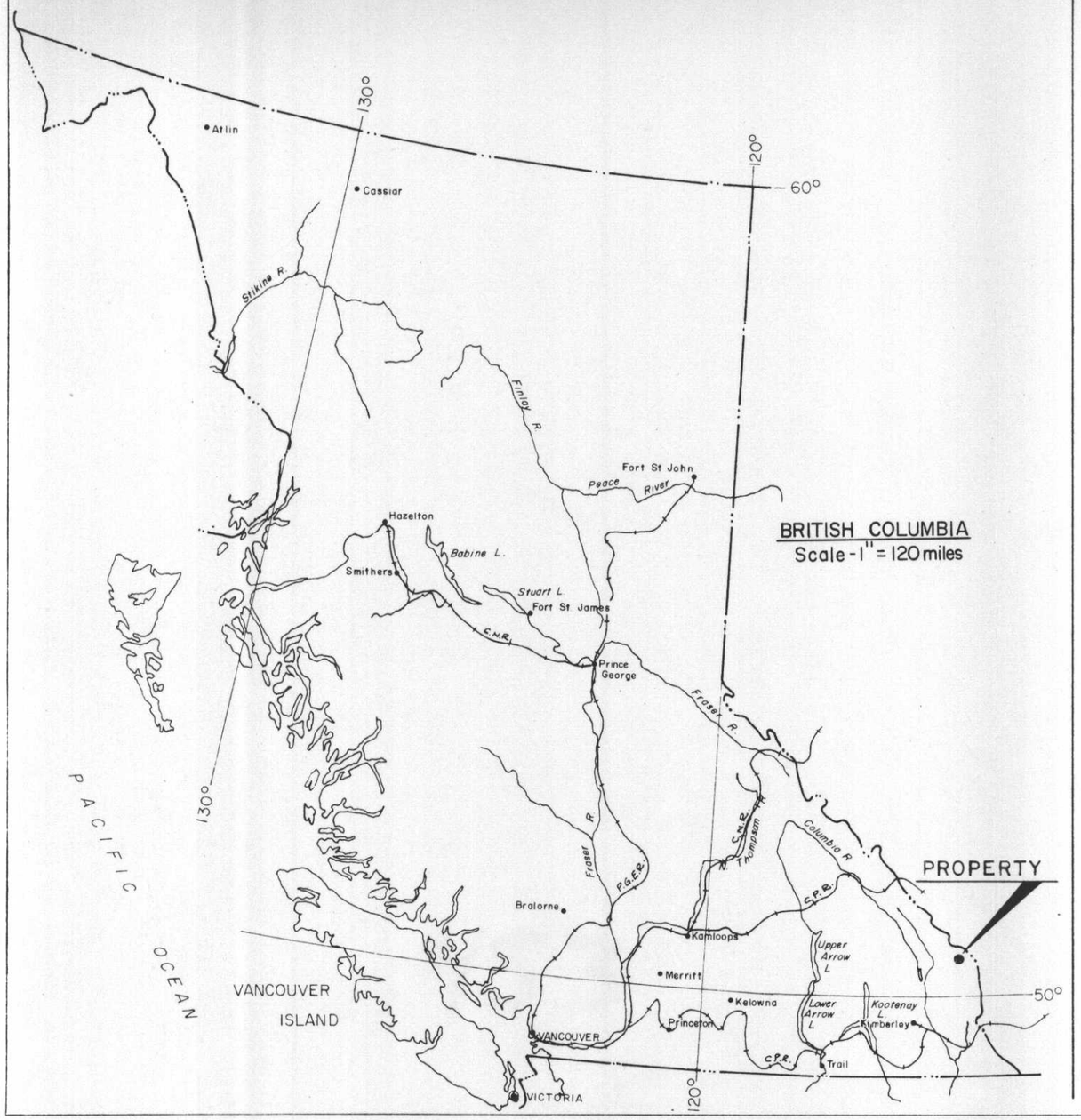
PLATE 4

Hand trench across a steeply dipping coal seam. Light coloured shale parting in upper part of the seam.

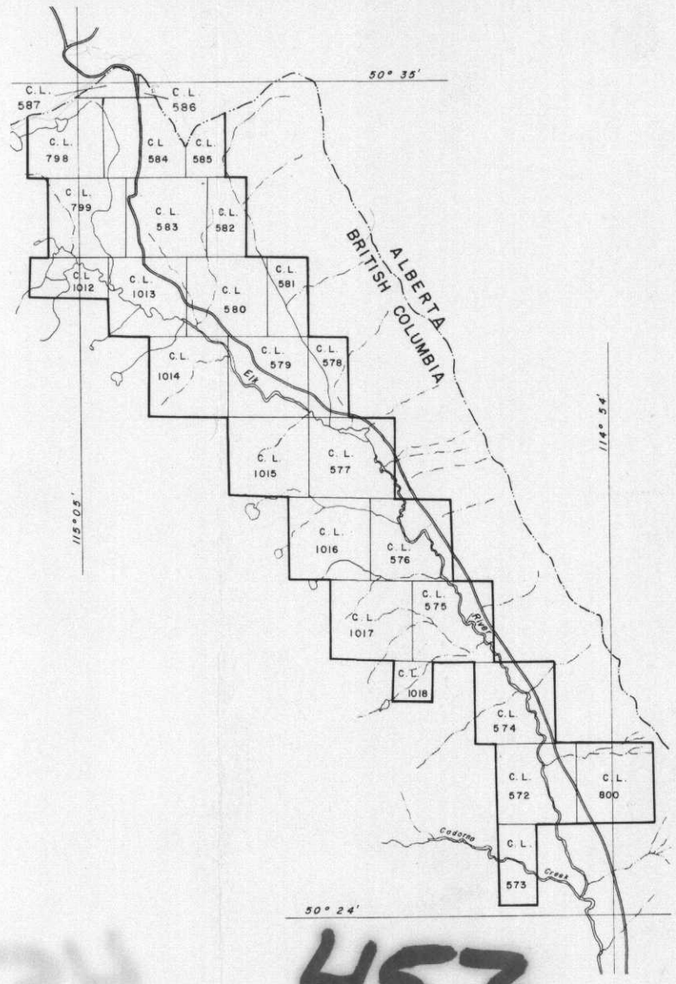
PLATE 5

Both photos illustrate road conditions in Elk Valley during the early part of field season.

PLATE 6



BRITISH COLUMBIA
Scale - 1" = 120 miles



Scale 1" = 2 miles

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PROFESSIONAL ENGINEER
PROVINCE OF BRITISH COLUMBIA
R. C. HART
Expiry Date: Mar. 3, 1972

RIO TINTO CANADIAN EXPLORATION LTD.

VINCENT OPTION — ELK VALLEY — B.C.

LOCATION MAP

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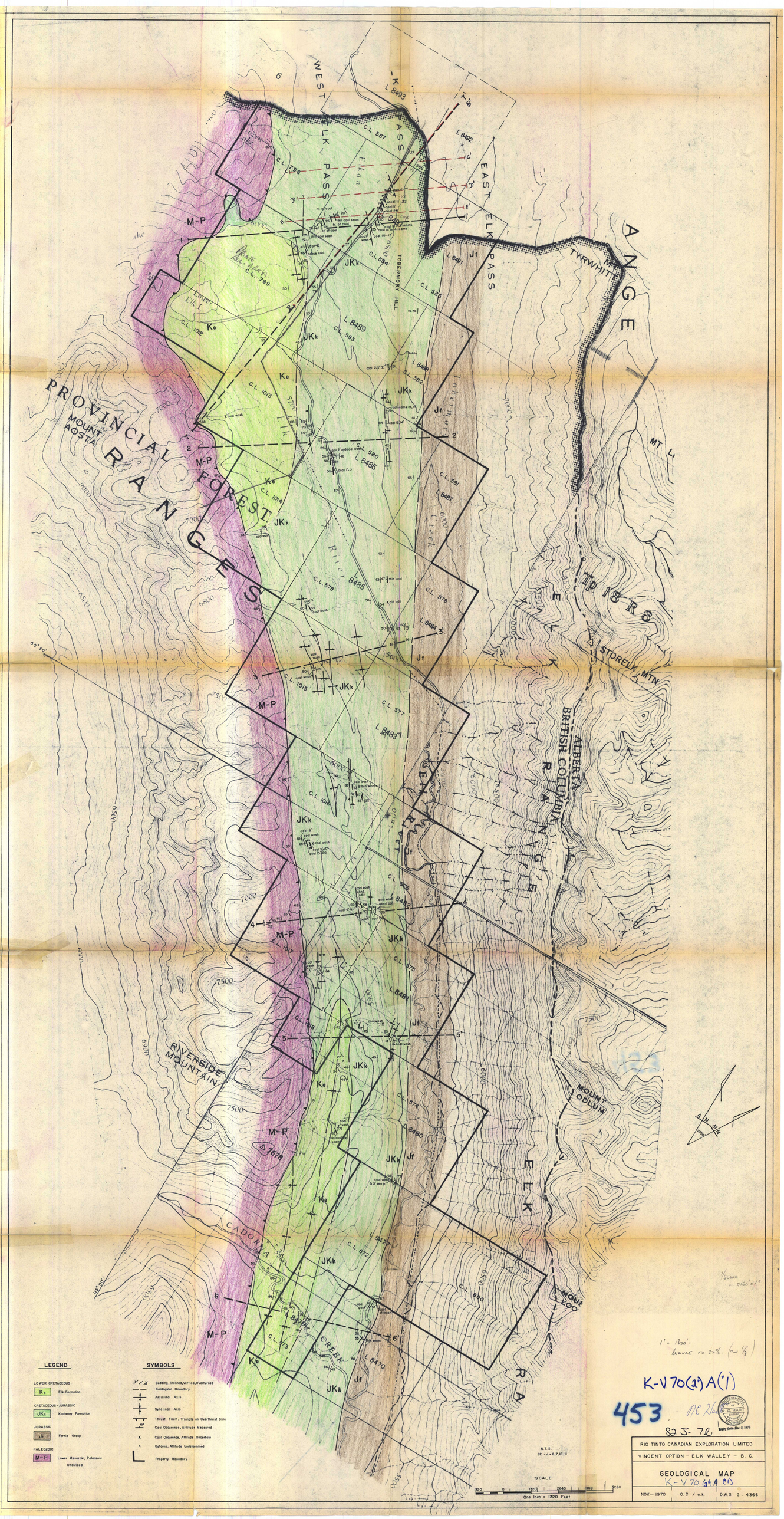
WEST ELK PASS
EAST ELK PASS
TOBERMORY HILL
TYRWHITT RANGE
PROVINCIAL FOREST
MOUNT AOSTA
RANGES
ELK RIVER
ALBERTA BRITISH COLUMBIA
RIVERSIDE MOUNTAIN
CADORNA CREEK
MOUNT LODLUM
STOREUX MTN
MT L
TP 18 R 8
LEGEND
LOWER CRETACEOUS
Ke Elk Formation
CRETACEOUS - JURASSIC
JKk Kootenay Formation
JURASSIC
Jf Fernie Group
PALEOZOIC
M-P Lower Mesozoic, Paleozoic Undivided
SYMBOLS
Bedding, Inclined, Vertical, Overturned
Geological Boundary
Anticlinal Axis
Synclinal Axis
Thrust Fault, Triangle on Overthrust Side
Coal Occurence, Attitude Measured
Coal Occurence, Attitude Uncertain
Outcrop, Attitude Undetermined
Property Boundary
SCALE
One Inch = 1320 Feet
N.T.S. 82 - J - 6, 7, 10, 11
RIO TINTO CANADIAN EXPLORATION LIMITED
VINCENT OPTION - ELK WALLEY - B. C.
GEOLOGICAL MAP
NOV - 1970
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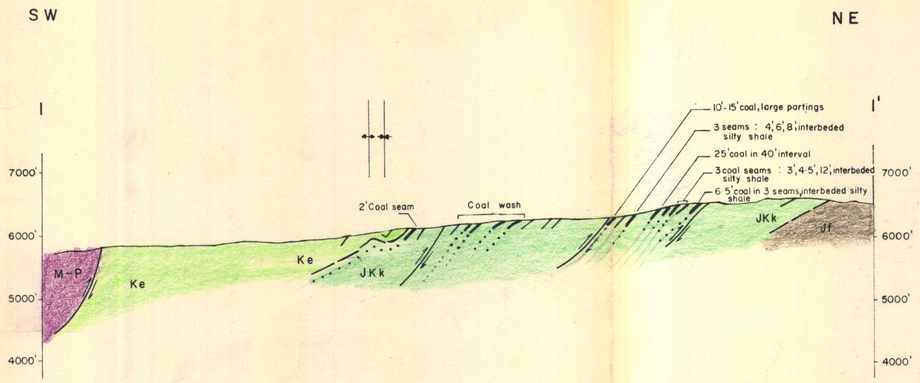
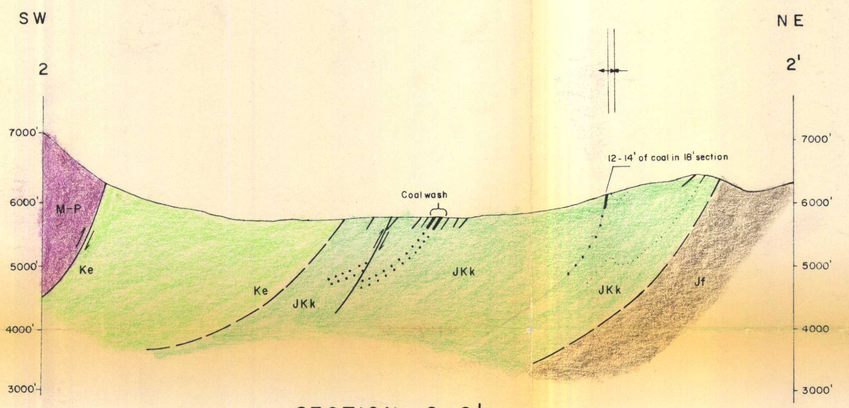


SECTION 1-1'



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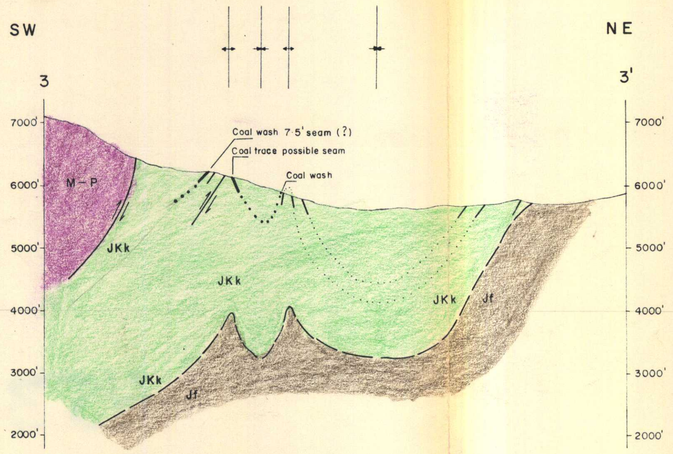

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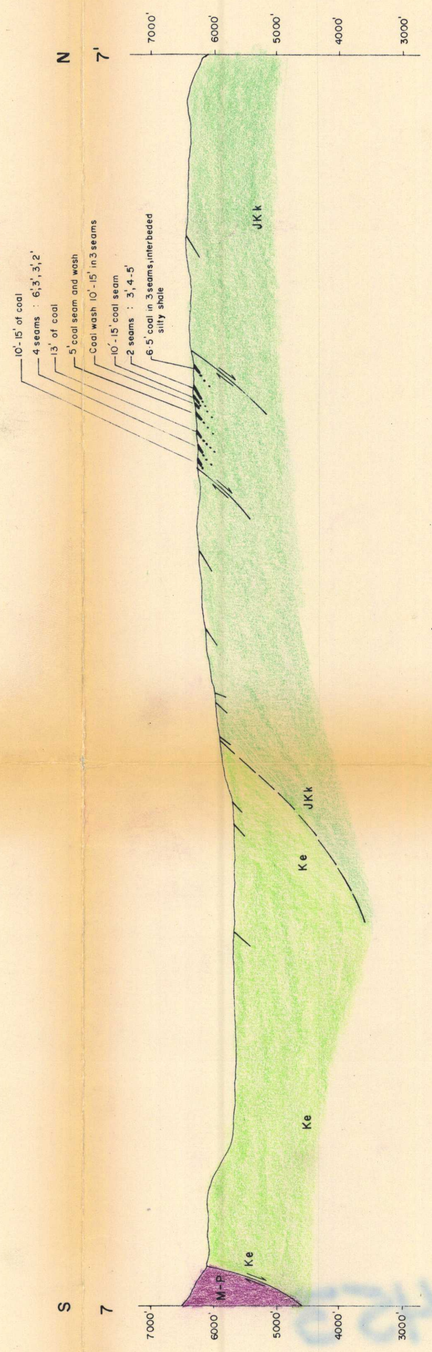

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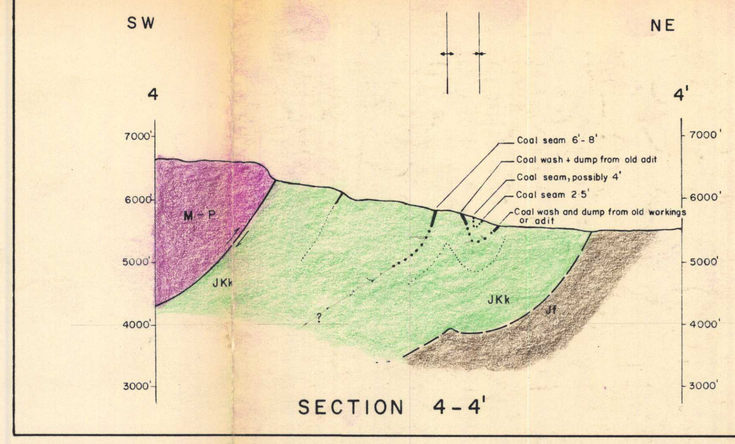

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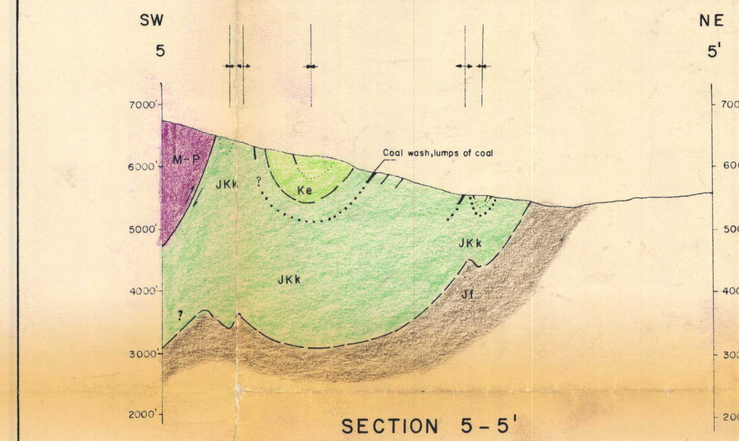
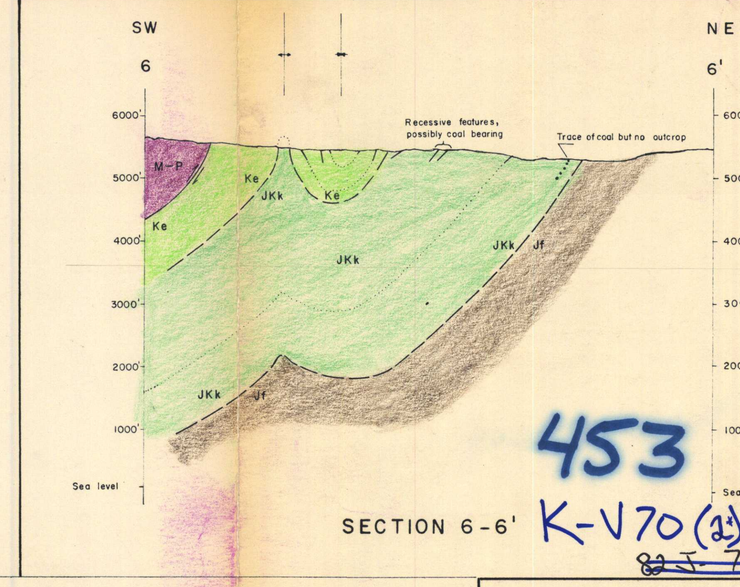


SECTION 5-5'



SECTION 6-6'

453

K-V70(2*)A(*1)

82-J-7

LEGEND

LOWER CRETACEOUS
- Ke — Elk Formation

CRETACEOUS - JURASSIC
- JKk — Kootenay Formation

JURASSIC
- Jf — Fernie Group

PALEOZOIC
- M-P — Lower Mesozoic, Paleozoic, undivided

Coal seam

Thrust fault

Geological boundary

N.T.S
82-J-6, 7, 10, 11

SCALE
1320 0 1320 2640 3960 5280
One Inch = 1320' Feet

PROFESSIONAL ENGINEER PROVINCE OF BRITISH COLUMBIA R. C. HART
Expiry Date: Mar. 3, 1972

RIO TINTO CANADIAN EXPLORATION LIMITED

VINCENT OPTION - ELK WALLEY - B.C.

K-V70(2*)A(*1)

STRUCTURAL SECTIONS

DEC. 1970 | O.C. / e.k. | DWG. G-335