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**BELCOURT PROJECT** 

INTERIM REPORT

# **OCTOBER**, 1971

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GEOLOGICAL BRANCH ASSESSMENT REPORT

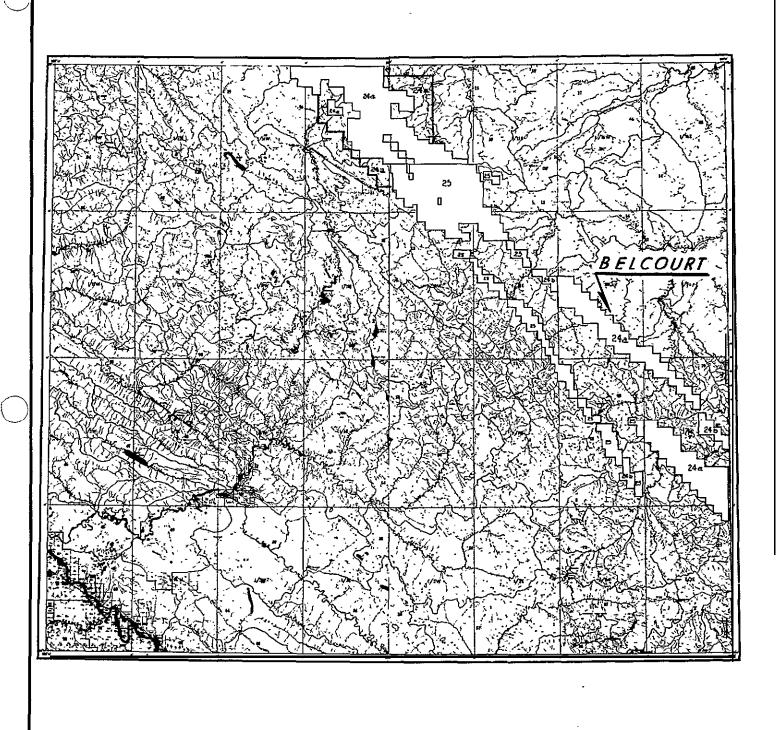


# A.C. MOULD

UNDER THE SUPERVISION OF A.A. JOHNSON

DENISON MINES LIMITED





PR-B71(1)A DENISON MINES LIMITED CALGARY, ALBERTA BELCOURT CLAIM MAP

DRAWN BY E.J.I. DATE: SEPT.<sup>4</sup>71 SCALE: I<sup>11</sup>=12 mile: APPROVED BY: DRAWING No: BLCR 71-0164-R01

## BRITISH COLUMBIA

Sage Creek Coal Ltd.
 Pacific Coal Ltd.
 Fernie Coal Mines Ltd.
 Grows Nest Industries Ltd.
 David B. Finlay
 Fording Coal Ltd.
 Emkay - Scurry
 Kaiser Resources ltd.

20. Rio Tinto Canadian Exploration Ltd. '
21a.Pine Pass Coal Company Ltd.

21a.Pine Pass Coal Company Ltd. 21b.Bayfund Industries Ltd. 23a.Brameda Resources 24a.Denison Mines Ltd. 24b.R. G. Campbell 25. McIntyre Porcupine Mines Ltd. 26. Cinnabar Peak Mines Ltd.

27. Trend Exploration Ltd.

46. Hogan Mines Ltd. & Texacal Resources Ltd. 47. Ayrshire Coal Co. Ltd..

48. Darsi Mines Ltd.

49. Cominco Ltd.

50. Canada West Petroleum Ltd.

51. Aston Resources Ltd.

52. Hogan Mines Ltd.

53. Alberta Coal Ltd.

54. Nickel Hill Mines Ltd. -55. Braneda Resources Ltd. & Teck Corp. Ltd.

## INTRODUCTION

Denison Mines Ltd. acquired 55 licenses (35,110 acres) in the Fall of 1970. The licenses, all in British C olumbia, 'are numbers 1428 to 14 82 inclusive. License #]447 comprises 550 acres while the remainder are 640 acres each (35,110 acres total). The rentals are due on October 16, 1971. 1

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A location map is included in this report.

During the summer of 1971, the licenses were mapped geologically. The exploration program consisted of:

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- a. photo-geological study
- b. helicopter assisted geological mapping (8 man crew)

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- c. trenching by hand of coal seams
- d. New aerial photography of the area
- e. preparation of a 1 inch 1/4 mile base map from Government topographic maps.

**General geological coverage was obtained and** detailed **mapping was restricted to coal bearing strata**.

## LOCATION AND ACCESS

The licenses lie 85 miles southwest of Grand Prairie, Alberta, Access to the southern part of Belcourt would be best achieved by extending the 20 miles of 4-wheel drive road built in I970 on the Saxon property. The extension would be 7 miles. The Saxon road is washed out and generally in poor condition. This would have to be cleared up. The road in turn connects to a good all weather gravel surface road going 100 miles to Grande Prairie.

The Northern end of Belcourt is best reached by building a 5 mile extension to the Wapiti River road, which in turn connects to the Redwillow River road. This is 80 miles to Grande Prairie.

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## TOPOGRAPHY

Elevations vary from 3000 to 6500 feet A.S.L. The area is fairly rugged. Tree line is about 5500 feet A.S.L., and fair exposure is obtained on ridges and creek beds. The area is drained essentially by the northeast flowing Red Deer Creek (in the North) and Belcourt Creek, and their many tributary creeks. Both valleys contain deep alluvial gravels. All valley bottoms and lower slopes are heavily timbered.

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## **GEOLOGY**

. Geological mapping was carried out using aerial photographs on a scale of  $1^n = 1/4$  miles as initial base. Much of the general information was gathered by helicopter assisted traverses along mountain ridges and creeks. Emphasis was laid on determining the sequence of coals, their attitude and continuity. Mapping was confined to the lower Cretaceous sediments.

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A map made by Dr. D. Stott was published in 1968 in the G.S.C. Bulletin 152. A week's mapping by 4 teams of geologists was completed in the summer of 1971.

STRATIGRAPHY:					
ſ	Ι		TABL	LE OF FORMATIO	NS.
Series	roup	<b>Formation</b> Dunvegan		Thi ckness	Li thol ogy
Upper				300- 1200'	Marine and non-marine, sandstone and shale.
Cretaceou		Commotion 1080 - 1600'   Shaftesbury 1400 - 1900'	Cruiser	350- 800'	Dark grey marine shales, sideritic concretions, some sandstone.
:	ort t.		Goodri ch	50-1350'	Fine grained, cross-bedded sandstone, shales and mudstones.
, i	ohn		Hasler	500- 1500'	Silty dark grey marine shale, sider- itic concretions, siltstone and sand- stone in lower part, minor conglom erate.
Lower Cretaceou			Boulder Creek	240- 560'	Fine grained, well sorted sandstone; non-marine sandstone and mudstone.
			Hulcross	0- 450	Dark grey marine shale with sideritic concretions.
			Gates	220- 1400'	Fine grained marine and non-marine sandstones; conglomerate, coal, shale and mudstone.
			Moosebar	100-1000'	Dark grey marine shale with sideritic concretions, glauconitic sandstones and pebbles at base.
	111head		Gething	75-1000'	Fine to coarse brown calcareous sandstone; coal carbonaceous shale, and conglomerate.
$\bigcirc$	ATTICAL		Cadoni n	45- 600'	Massive conglomerate containing chert and quartite pebbles

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The oldest Cretaceous rocks compose the Nikanassin This is in excess of 2500 thick. In the field this Formation. formation is readily divided into a lowermost 500' of medium sandstones. These contain pelecypods and gastropods, suggesting a marine to brackish environment. The upper 2000 feet is a rapidly alternating sequence of sands, shales, with thin coals, and calcareous bands. This suggests oscillating sea levels and/or source area. This formation underlies the rocks of economic interest. It is highly disturbed (i.e. tight chevron folding) and this type and intensity of deformation is not exhibited by the overlying younger strata. This feature of the Nikanassin can be either explained as pre-Cadomin orogeny or as a function of incompetent lithology. At this time, without detailed work, it would appear that the latter explaination is more plausible.

The Cadomin conglomerate has a maximum development in the environs of Belcourt Mountain where it attains a thickness of about 500 feet. From this point it thins in a general northeast and southwest direction. It forms conspicuous topographic features, and is also found as small outliers. Its usefulness as a marker is obvious in the monotonously developed Nikanassin sequences.

The Gething Formation disconformably overlies the Cadomin. It has a minimum development on Belcourt Mountain. It thickens from this point from 50 feet to 300 feet in generally a northeast and southwest direction at the expense of the Cadomin. The boundary lies between these 2 formations and is diachronous. The Gething consists of about one third sands and two thirds shales. There are presently thought to be 3 <u>continuous s</u>eams in the Gething with an aggregate thickness of about 27 feet. One thick seam has been noted in two locations immediately overlying the Cadomin. This seam is about 30 feet thick. It , has not been seen anywhere else, for this reason, and its relative thickness, this-coal presents a problem at the moment. Its great thickness in the 2 locations where it has been measured can possibly be explained on structural grounds. The local nature of its occurence might be best explained in terms of intrinsic depositional surfaces. Because of its nature the Cadomin probably formed topographic prominences supporting thin veneers of vegetation. Contemporaneous low areas my have supported luxuriant growth: Another explanation for these coal beds might be found by a comparison with Lummock development in the Mississippi Delta. 7

The Moosebar shales form distinctly recessive morphologic features and are very useful in isolating the Gething formation from the Gates'member in the field., It appears to be distinctly shaley in this region with no arenaceous incalations. It passes graditionally upwards into the Gates sandstones.

The Commotion has a three fold division, which is readily recognizable in the field. The Gates member is the only one of economic significance. This consists of about equal parts of shales and sands with occasional conglomerate bands. The exposures in the Gates were generally poor, and did not permit the correlation , of coal horizons from ridge to ridge. Refering to the Belcourt section submitted in this report, which is a composite of two field 'traverses, it can be said that there are eight or nine coal forming horizons constituting, an aggregate thicknes of about 88 feet of coal.

The Gates is overlain by Hulcross marine-h is in turn overlain by the conspicuously mappable Boulder Creek horizon.

The Shaftesbury shales overlie the Boulder Creek and form probably part of the recessive topography to the northeast of the Belcourt property.

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The entire Denison Mines license area lies in a typical Foothills or Disturbed Belt thrust plate. This thrust places lower Cretaceous on the upper Cretaceou Kaskapou Formation.

Mapping in 1971 delineated two smaller thrust faults, one restricted entirely to Nikanassin Formation and another placing the Nikanassin formation on the Gates member of the Commution Formation.

The general attitude of the coal seams is  $320^{\circ}/-50^{\circ}$ northeast. The seams have been eroded by several creeks CrOSScutting the structural trend. The seams must be truncated at depth by the large thrust mentioned above; the exact horizon of this truncation is not known at this time. For this reason it is not considered in reserve calculations.

In the reserve calculations below, the Belcourt property has been divided into four blocks. The structure of these blocks is discussed more thoroughly in the reserve calculations.

#### **POTENTIAL COAL IN PLACE**

- Block 1 . North of Red Deer Creek. This block is structurally However, one structure, namely the northeast dipping comlex. limb of the anticline at the extreme northeast corner of the property, seems to be continuous enough to merit further investigation. Here it would appear from the relationships of formational contacts that the Gates' member is possibly undisturbed for 2 miles along strike. No coal seams were measured in the field, and no drill hole information is available for the Belcourt property. An aggregate thickness of 50 feet of coal in the Gates has been used in estimating a potential coal in place for this structure in Block 1. This is a reasonable assumption (c.f. block #3). The attitudes in this structure are steep and dipping to the north east.
  - a. Potential coal above drainage (4200 A.S.L.)= 20 million tons
  - b. Potential coal below drainage to a working depth of
     1500 feet = 24 million tons.

Therefore the potential coal in place = 44 million tons.

Block 2 - South of Red Deer Creek to Holtslander Creek.

The exposure in this block was very poor. Where sporadic outcrop was mapped, the strata were dipping northeast at about  $40^{\circ}$ . No coal was seen in the field and again an aggregate thickness of 50 feet has been assumed for reserve calculations. A complete section of Gates is probably not present in this block as the Gates would seem to be truncated by a thrust fault which has been extrapolated from adjacent areas of better exposure. Continuity within the Gates strata present in this block has been inferred from the apparently undisturbed formational contacts underlying the Gates to the southwest.

The economically interesting section of the Gates would seem to have an outcrop of 18,000 feet along strike.

a. Potential coal in place above drainage = 36 million tons

b. Potential coal in place below drainage to a mining depth

of 1500 feet = 42 million tons.

Total potential coal in place = 78 million tons.

Block 3 - South of Holtslander Creek to Belcourt Creek.

In this block, Nikanassin and locally younger formations are overthrust onto the Gates. The Gates is otherwise undisturbed and maintains fairly constant attitudes, dipping northeast at about 50" throughout the block. The Gates is overlain conform ably by the Hulcross and Boulder Creek members of the Commotion Formation to the northeast. These are in turn overlain by the younger Shaftesbury Formation containing its characteristic "fish scale" fauna. Exposure in the Gates was good along this structure and as much as 96 feet of Gates coal was measured on Using an aggregate thickness of 80 feet of coal for traverse. this block one arrives at:

- a. Potential coal in place above drainage (3000 A.S.L.)
   Belcourt Creek = 160 million tons.
- b. Potential coal in place below drainage to a mining depth of 1500 feet = 16 million tons.

Total potential coal - I76 million tons.

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<u>Block 4</u> • South of Belcourt Creek to the southern limit of the property.

The Gates in this block is structurally impoverished by an underlying thrust fault. The dips in the Gates and older strata average about 50<sup>°</sup> to the northeast. Coal horizons within the Gates have an exposure along strike of 16,000 feet. As in block 3, the coal beds dip with the topography, though at a steeper angle. This situation might lend itself to strip mining. On the basis of the coal seen on the nearest traverses with good exposure, an aggregate of 60 feet of coal in the Gates is a reasonable assumption for this block. One then arrives at:

- a. Potential coal in place above drainage (3000 A.S.L. at Belcourt Creek) = 37 million tons
- b. Potential coal in place below drainage to a mining depth of 1500 feet = 10 million tons

Total potential coal = 47 million tons A total potential coal in place for the Gates member is about 345 million tons.

## POTENTIAL COAL RESERVES IN THE GETHING FORMATION

/ Three coal seams were mapped in the Gething Formation in the field. They were seen on two traverses in the area designated Block 3. It is reasonable to assume that these three seams of thicknesses 5, 7 and 15 feet are continuous at least for the strike length of Block 3. The Gething Formation conformably underlies the Gates member. Assuming an aggregate thickness of 21 feet (i.e. ignoring the 5 foot seam) the potential coal in place in block 3 is:

a. Potential coal in place above drainage = 40 million tons.
b. Potential coal in place below drainage to a mining depth of 1500 feet = 4 million tons.

Total potential coal = 44 million tons

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A total potential coal in place for Belcourt (both in the Gates and in the Gething) = 389 million tons.

## **COAL QUALITY**

No coal quality analyses are available for the Belcourt property. However, drilling on a nearby project indicates that the coal seams in the commotion and Gething Formations are probably , of a metallurgical grade. The coal seams in this area were deposited at the same time, in the same environment, and have suffered the same metamorphism There is therefore, every reason to expect that their present properties will be the same. The clean product can be expected to have the following properties: 19

Ash:	6 - g %
Volatiles:	21 - 27 %
Fixed Carbon:	<b>65 -</b> 72 %
F.S.I.:	5 - 7
B.T.U.:	13, 000 - 14, 000
Sul phur:	0.3 - 0.4 %
Rank:	Medium volatile bituminous

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## **RECOMMENDATIONS**

Several drill holes have been recommended. Top of seam trenching between holes obtaining encouraging coal intersections and qualities is also recommended to test continuity of the structure and also bring to light any pattern of faults (and their type) which might exist along or across the structural trend. 14

Mapping of joint and fracture patterns and faults observed in seam trenching will be invaluable to eventual underground mine and/or pit wall slope design. Cat 'cross cut' trenches will enable optimum location of drill hole sites, and also seam thicknesses in trenches will be obtained every 500 feet along the strike by small cross cuts off the top of seam trench.

Holes #1 to 5 inclusive are located on the sections and map accompanying this report.

## **Hole** #1

This hole is located towards the southern end of the property, It will be about 600 feet. It is inclined at 45<sup>0</sup>. <u>Hole #2</u>

This is a longer hole. - 1300 feet approximately. Well documented field traverses have noted significant seams in the upper Gates in this vicinity. It is intended that hole #2 will pick these seams up. It is an angle hole, dipping at 45<sup>0</sup>. Hole #3

This hole is 1300 feet, its inclination 45<sup>°</sup>. Like hole #2 this hole will test for coal seams within the Gates. It is adjacent to a ridge traverse on which seams were noted throughout the entire Gates sequence. 16

**Hole** #4

About 1000 feet, inclined at 55<sup>0</sup>. This is designed to test coal seams and structure within the Gates in an area which was poorly exposed. It will also furnish information at a point well removed from other sources of information.

Hole #5

It is the design of this hole to tie in the northern block of Belcourt property with the other three southern blocks. A 1500 feet hole inclined at 45<sup>0</sup> will furnish information on the northeast dipping linb of an anticline.

It is suggested that holes 1, 3, and 5 be diamond drill holes. This is to test for structures within the coal bearing Gates member. One can determine bedding attitudes, faults and fractures and true thicknesses from the core. Comparison of rock types in the cores will be related to the radiation logs obtained from the holes. This will allow better interpretation of the logs themselves.

All holes will be radiation logged. This will hopefully allow correlation of seams and facies from hole to hole, across the entire property. The holes are located spatially to optimize this possibility. The density logs' will also allow quality determinations of the coal seams. By comparing the radiation logs of the supplementary potary holes with those of the coned holes it will be possible to determine strata thicknesses and types in the relatively "blind rotary holes.

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Total drilling recommended is 5700 feet. 35 miles of cat trenching and road building will be required.

#### CONCLUSIONS

The Belcourt property has a high reserve of potential coal in place, possibly 389 million tons, which is most likely coking. Of this figure about 20 percent would be recoverable, giving a potential saleable coal of 77 million tons. A large proportion, approximately 70 percent, of this is above drainage. Thus mining techniques would be simpler and costs lower for this coal.

From initial mapping it would appear that the economically interesting formations are structurally continuous.

A program of trenching and drilling has been recommended to give information on coal quality, continuity, and thicknesses. As mentioned elsewhere in this report, potential strip mining areas exist on this property. Estimates of tonnage and strip ratios for these areas would not be accurate at this time; they requre drill hole information.

#### STATEMENT OF QUALIFICATIONS

Mr. Alan A. Johnson planned and directed the exploration of Denison Mines Limited's Belcourt project subsequent of May 1, 1971. The field mapping was done as directed by Mr. A. C. Mbuld with the assistance of various geologists and student geologists assigned to the project.

Alan A. Johnson, B.Sc., graduated in Geology from Mount Allison University in Sackville, New Brunswick in 1963. Mr. Johnson has had a number of years experience as a geologist employed by mining companies in British Columbia. He currently holds the position of Chief Geologist (coal) for Denison Mines Limited.

Mr. Anthony C. Mbuld, B.Sc., graduated in geology from Sheffield University, Yorkshire, England in June 1968. Subsequent to his graduation Mr. Mbuld has worked for mining companies in British Columbia and Yukon Territory. He is presently employed as a project geologist for Denison Mines Limited.

I consider both the aforementioned geologists to be well qualified to undertake the responsibilities with respect to this project. I am satisfied that the attached report dated October, 1971 has been competently prepared and fairly represents the information obtained from this program

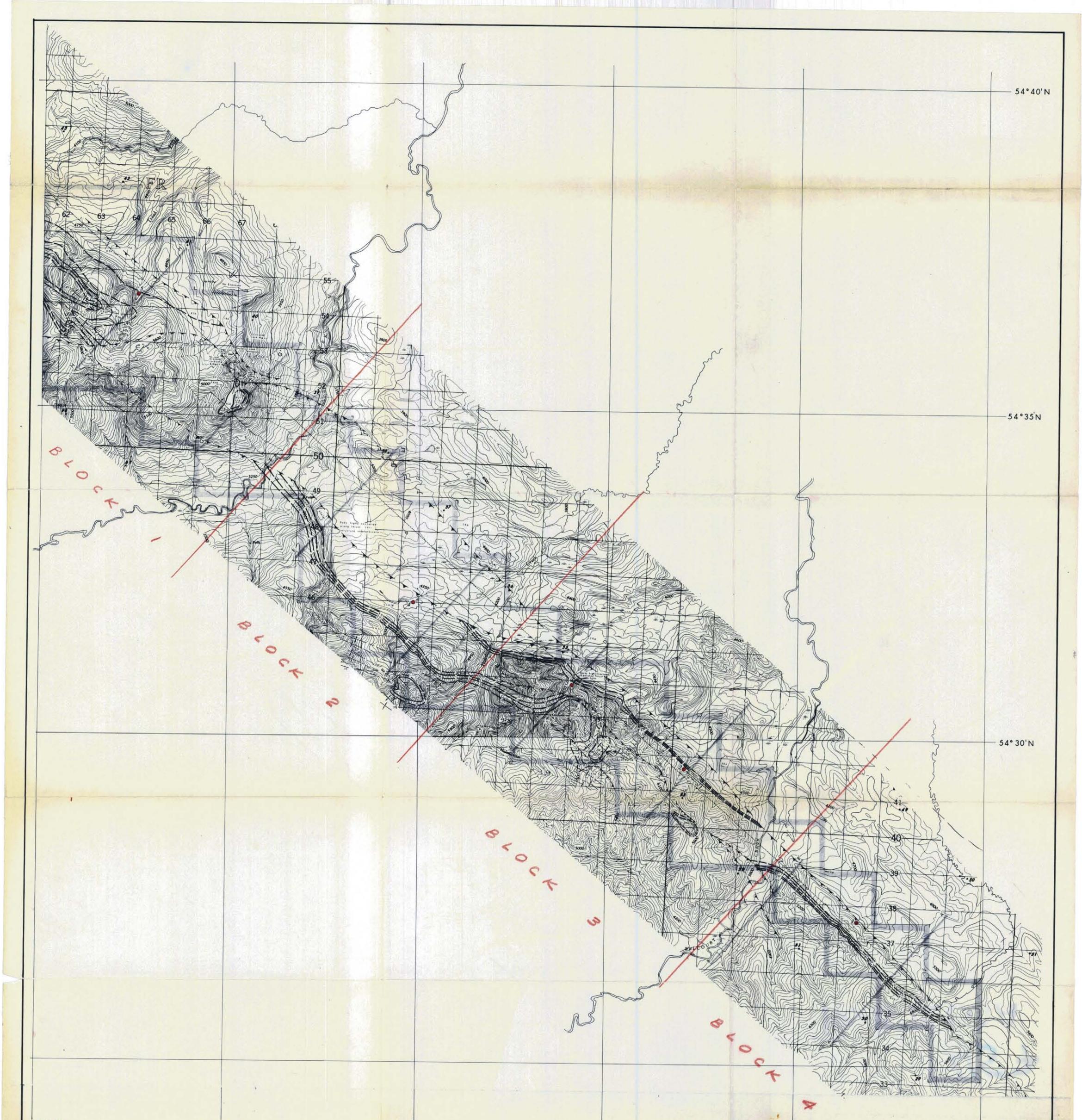
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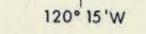
**October 14, 1971** 

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Existing drillhole
 Proposed drillhole
 Road or trail
 Dip & strike
 Faults
 Syncline

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+ Anticline

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- Cross-section lines
- Denison's property

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BELCOURT GEOLOGY

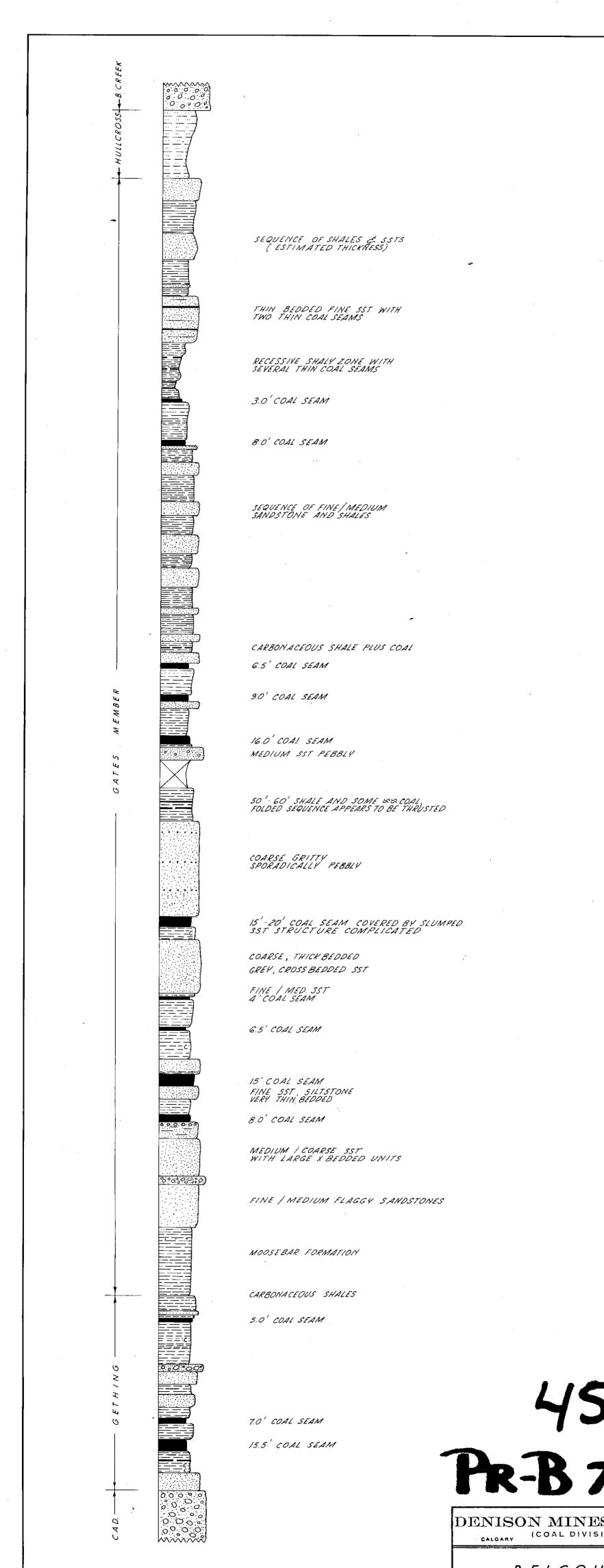
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Drawing No: BLCR 71 - 0152 - R02

Scale: 1: 50,000

Drawn by : A.M.

Approved by:



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DENISON MINES LIMITED (COAL DIVISION)

BELCOURT STRATIGRAPHIC SECTION

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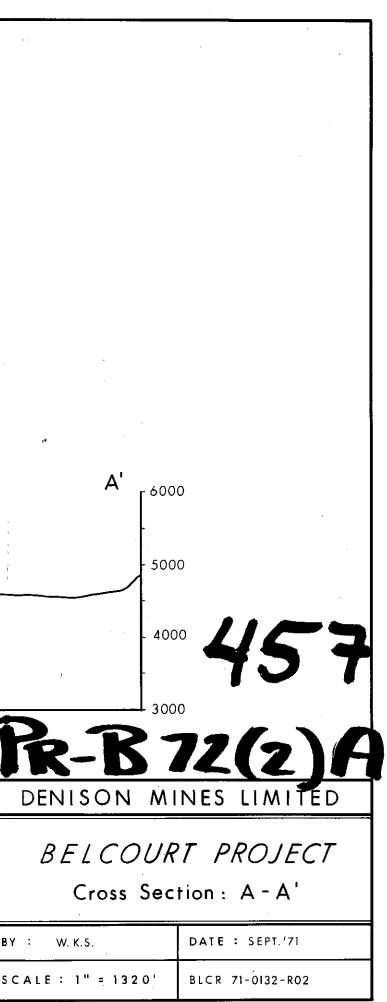


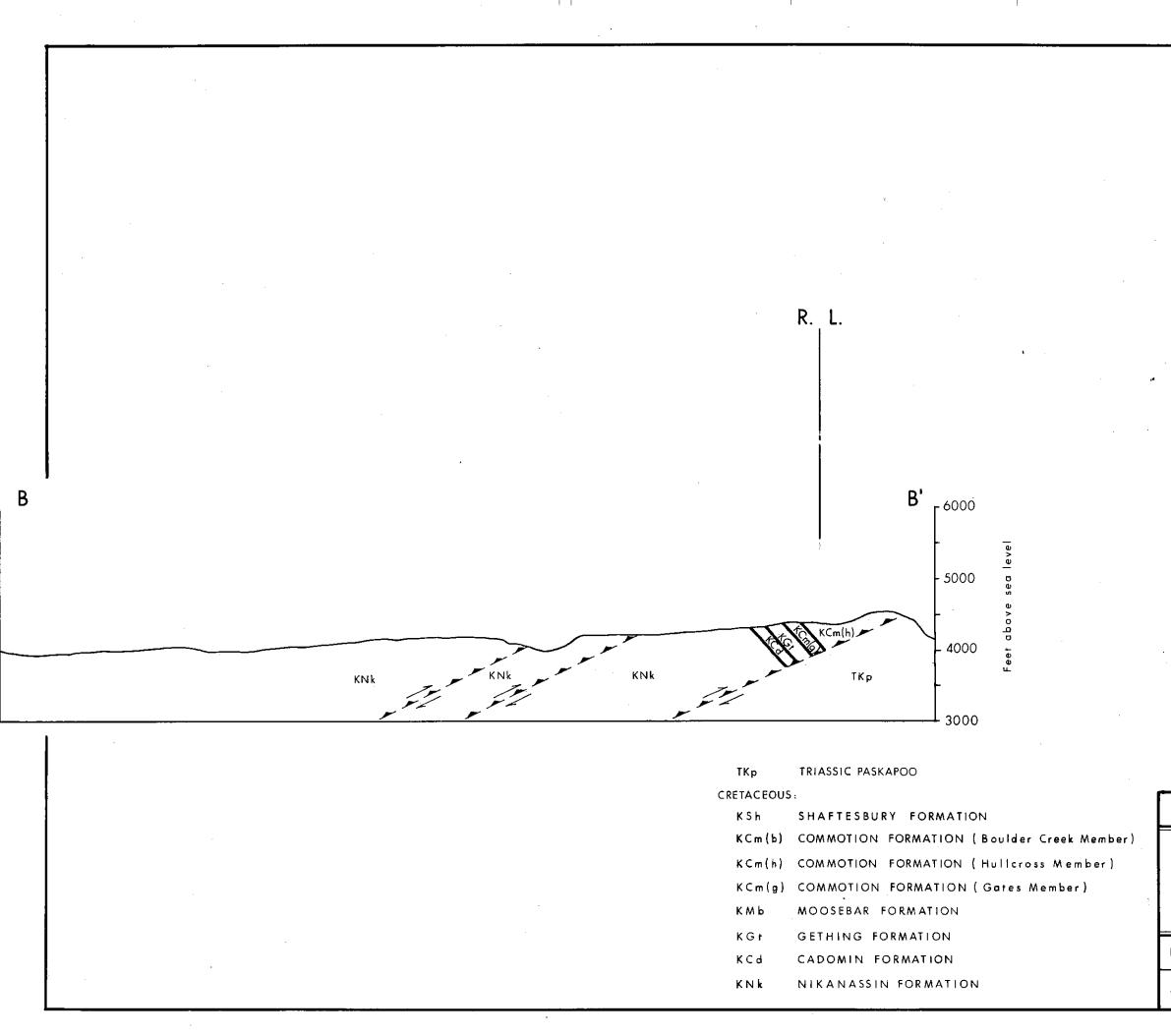
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			KGI GETHING FORM	
			KCd CADOMIN FOR	
			KNK NIKANASSIN F	ORMATION

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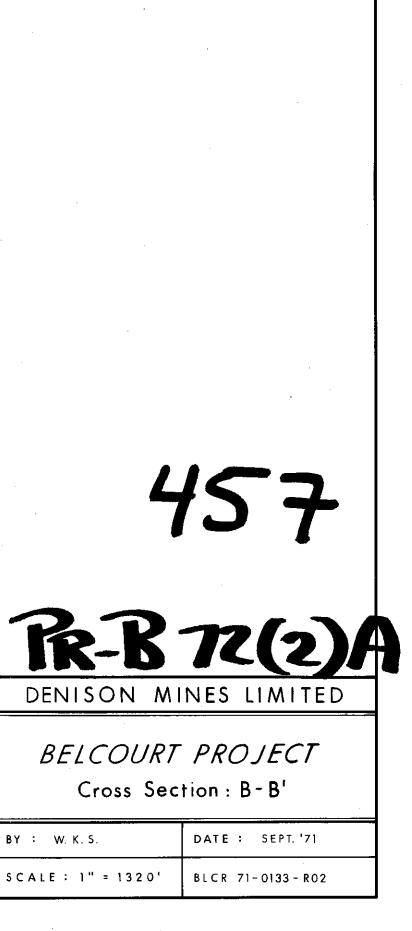
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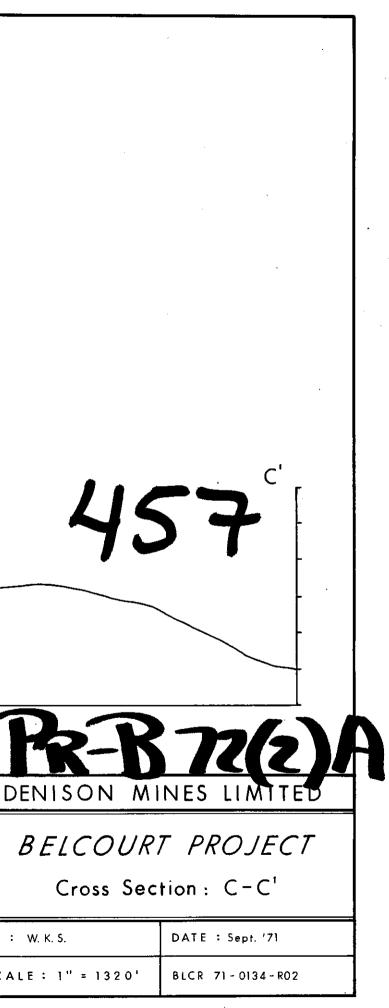


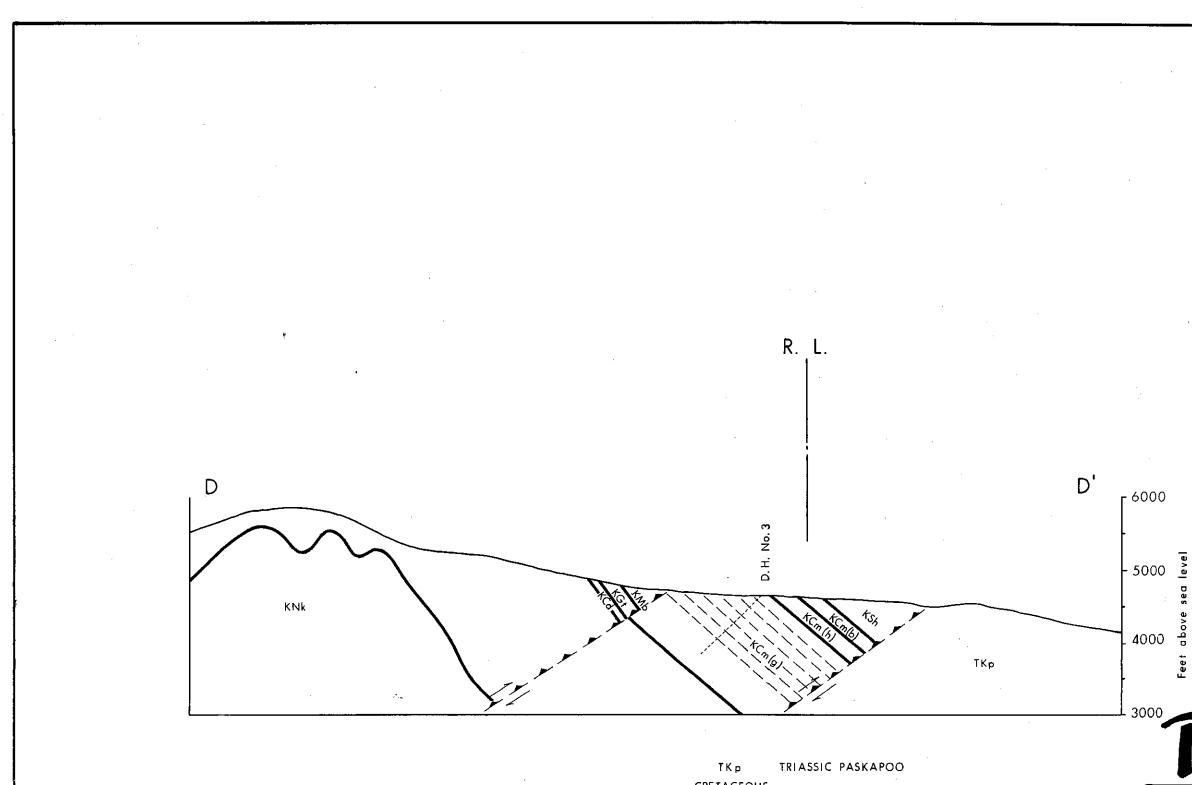
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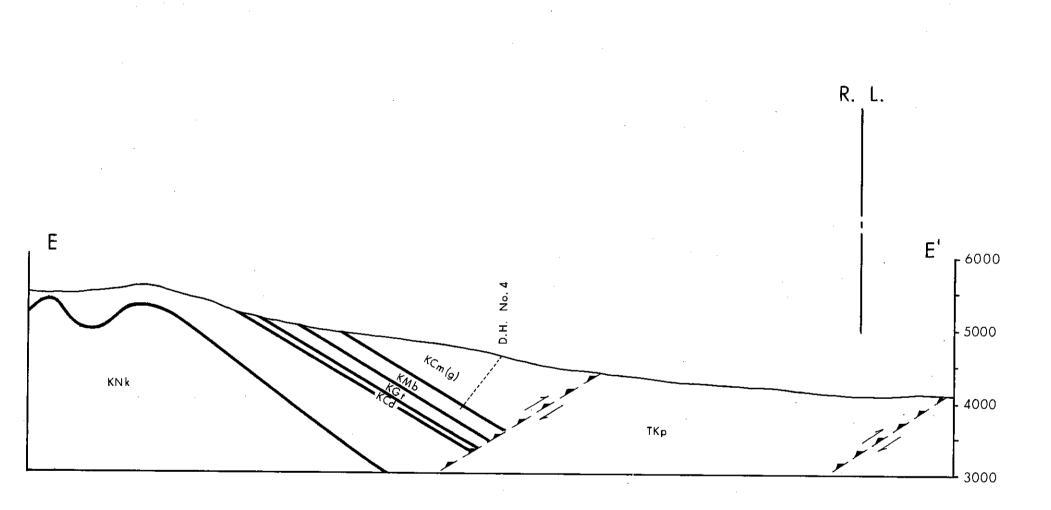
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	KCm(h)	COMMOTION FORMATION (Hullcross Member)	
	K C m (g)	COMMOTION FORMATION (Gates Member)	
•	КМЬ	MOOSEBAR FORMATION	
	KGt	GETHING FORMATION	<b> </b>
	КСd	CADOMIN FORMATION	B`
	KNk	NIKANASSIN FORMATION	s

<sup>o</sup> <sup>1</sup>/<sub>1</sub> 457 <sup>v</sup>/<sub>1</sub> 457 <sup>v</sup>/<sub>1</sub> 87 <sup>v</sup>/<sub></sub> DENISON MINES LIMITED BELCOURT PROJECT Cross Section : D-D' 3Y : W.K.S. DATE : Sept. '71 CALE: 1" = 1320' BLCR 71-0135-R02

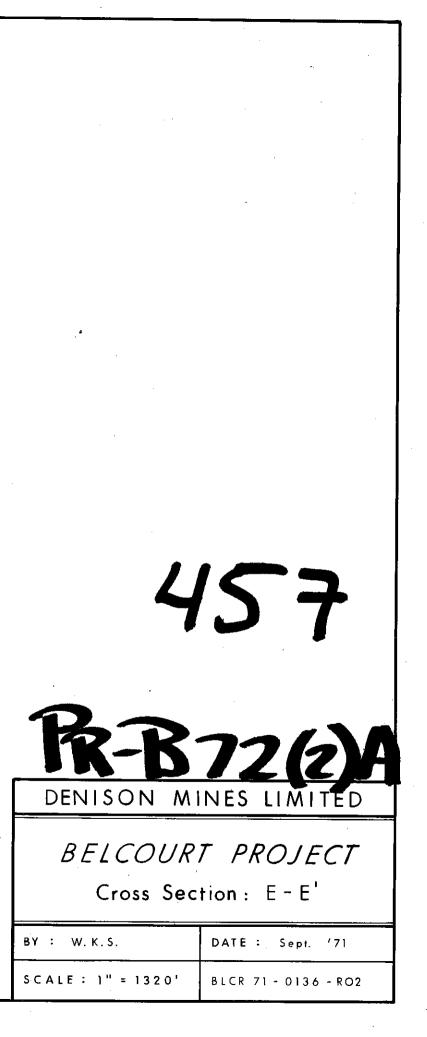


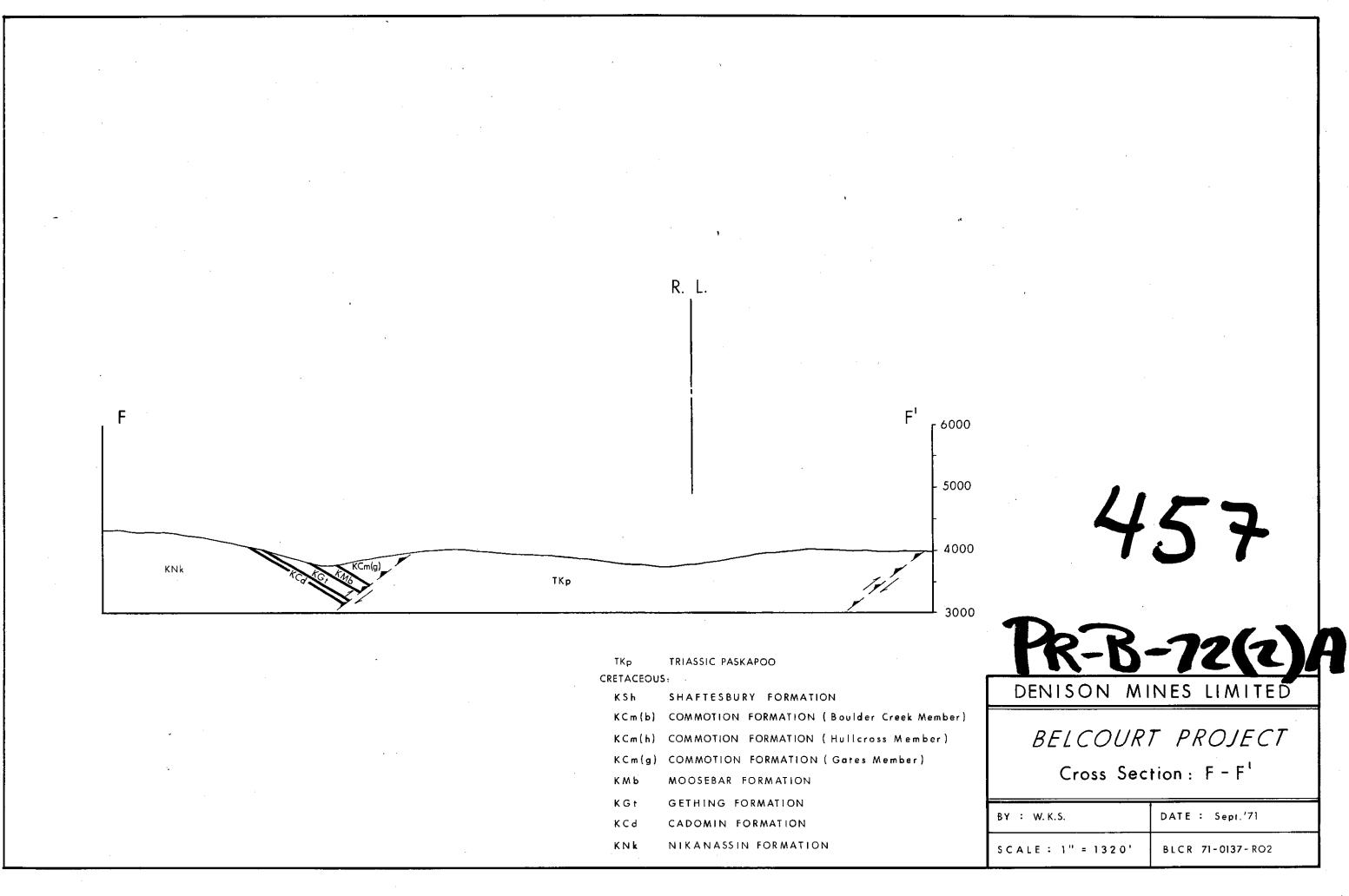
TKp TRIASSIC PASKAPOO

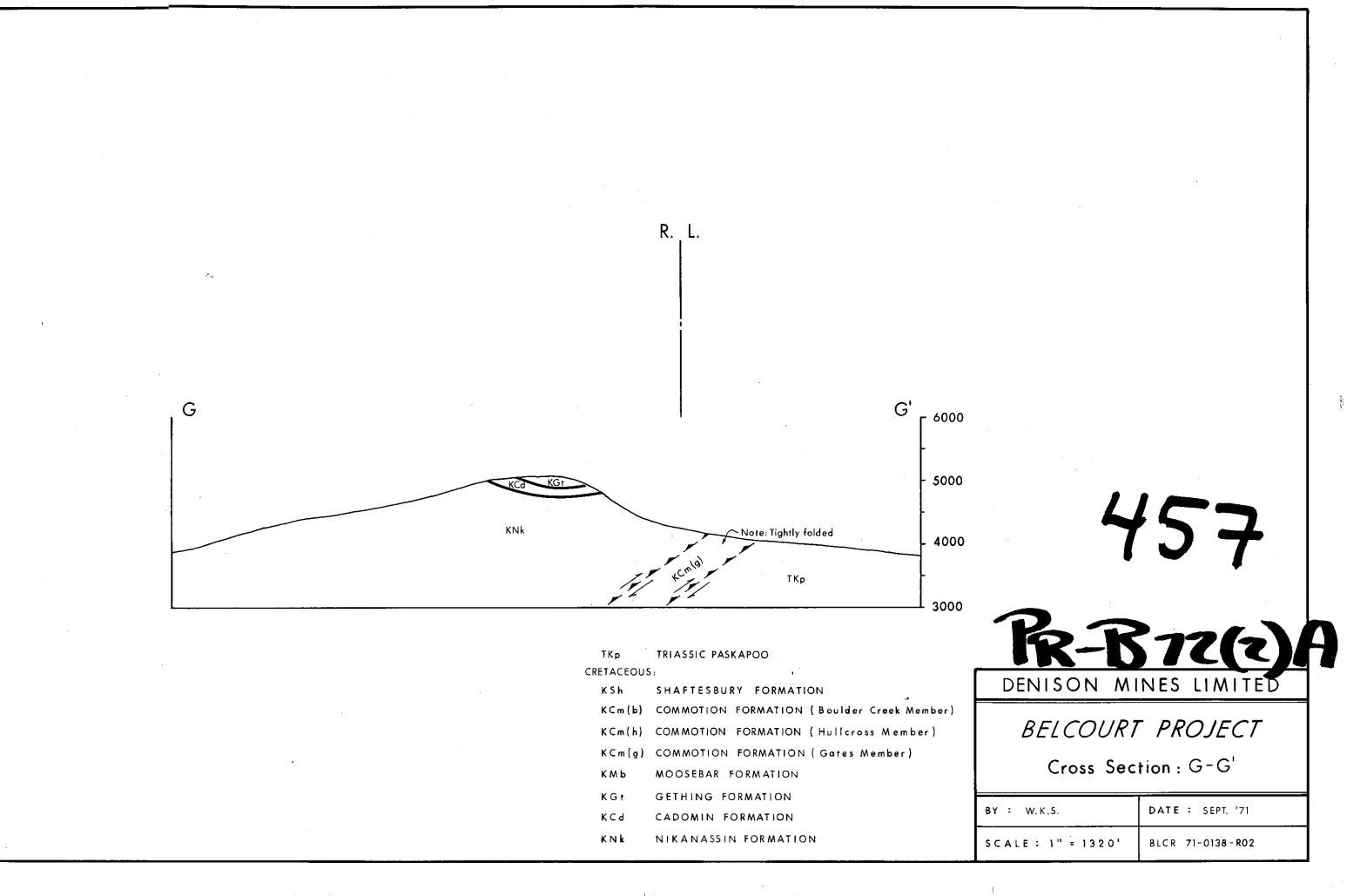
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- KCd CADOMIN FORMATION
- KNK NIKANASSIN FORMATION







REFACEOU	o,t i
KSh	SHAFTESBURY FORMATION
K⊂m (b)	COMMOTION FORMATION (Boulder Creek Member)
K C m ( h )	COMMOTION FORMATION (Hullcross Member)
K ⊂ m (g)	COMMOTION FORMATION (Gates Member)
КМЬ	MOOSEBAR FORMATION
KGt	GETHING FORMATION
КСd	CADOMIN FORMATION
KNK	NIKANASSIN FORMATION

