

OPEN FILE

NORTHERN COAL MINES LTD.

BOWRON RIVER DEPOSIT

Excerpt from

"Coal Resources of British Columbia"

-Part 4- "Southern Interior Coalfields"

Prepared by Dolmage, Campbell & Associates Ltd.

for

British Columbia Hydro and Power Authority

1975 -

00011

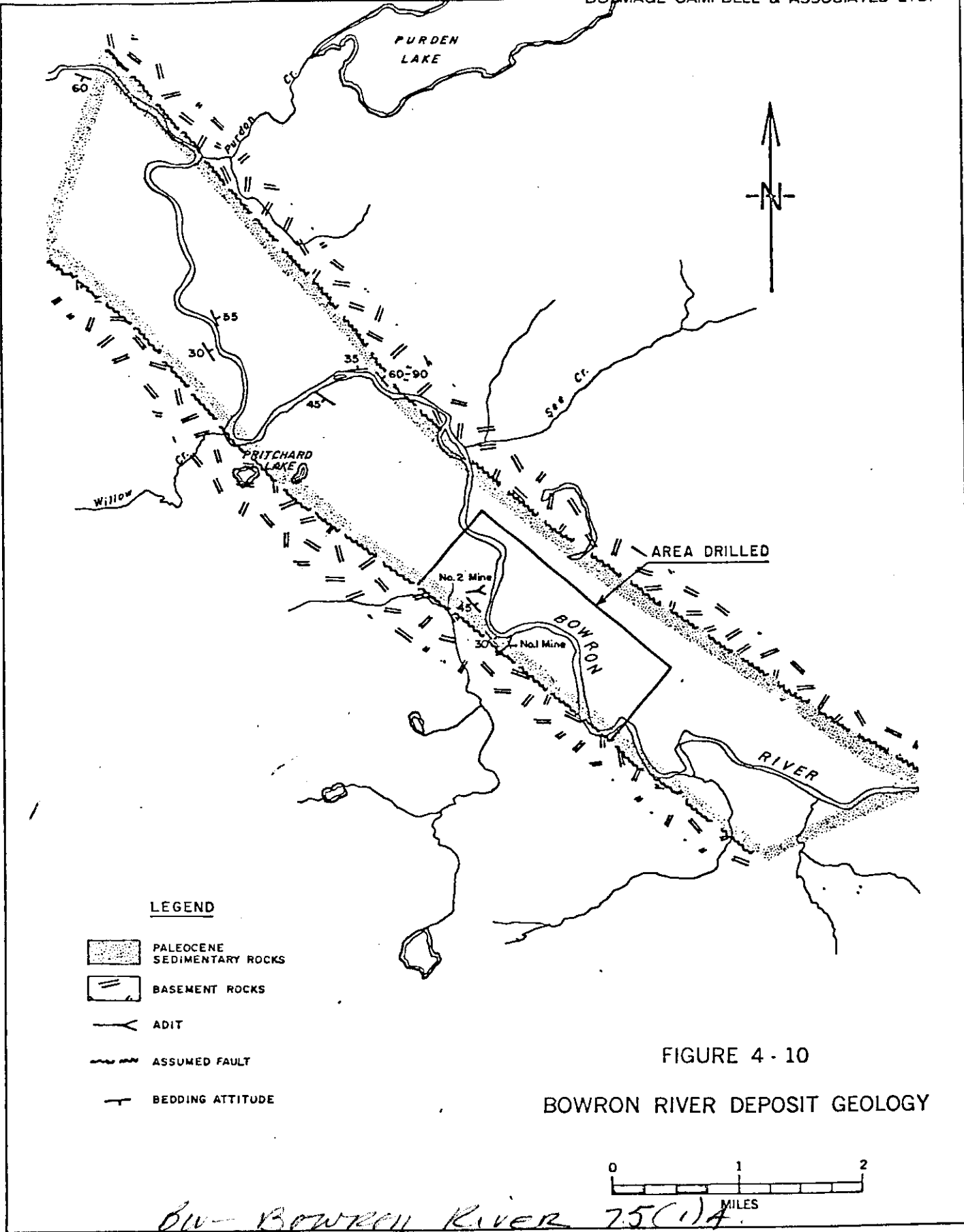


FIGURE 4 - 10

BOWRON RIVER DEPOSIT GEOLOGY

BW - Bowron River 75(1)A

4.5 PALEOCENE COAL

Coal of early Tertiary age occurs on the Bowron River 35 miles east of Prince George. Analyses on fossil pollen grains by Dr. G. E. Rouse of the University of British Columbia in 1969 indicates that the age of the coal measure lies between middle Paleocene and mid-Eocene with a chance of early Paleocene.

BOWRON RIVER DEPOSIT

Introduction

Discovered in 1871 by G. M. Dawson, coal occurrences were initially explored prior to 1914. The deposit lay dormant until 1946 from which time a series of companies have conducted sporadic exploration activities, each contributing to the overall knowledge of the coal occurrences. During this period, extending to 1970, several hundreds of feet of underground entries were driven from two adits and at least 42 holes were drilled.

In 1971 the property was optioned to Bethlehem Copper Corp. Ltd. by the current license holders Northern Coal Mines Ltd. Bethlehem drilled five diamond drill holes totalling 7474 feet.

The property presently consists of three coal licenses, numbered C.L. 148, 162, 163, and 16 adjoining licenses which have been applied for but not yet approved.

Access to the property, which is situated in the flat-bottomed valley of the Bowron River, is provided by six miles of gravel road which runs southerly from the newly-constructed Provincial Highway No. 16, joining the highway at a point 32 miles east of Prince George. The nearest railroad connection to the property is located in Prince George, from which point rail transportation is available to the seaports of Prince Rupert and Vancouver.

Geological Setting

The pre-Tertiary rocks that underlie the Bowron River area, (Fig. 4-10), comprise a sequence of sedimentary and volcanic rocks of Mississippian age called the Slide Mountain Group. This group consists of greenstone, flow breccias, argillite, cherts, and minor limestone that have been moderately folded. Occurring within a northwest-striking graben structure of regional magnitude, Tertiary sedimentary rocks that contain coal unconformably overlie the Mississippian basement assemblage. In the vicinity of the known coal deposits, the graben attains an average width of $1\frac{1}{2}$ miles, but extends northwestward and southeastward beneath overburden for an unknown distance.

The local geology, (Fig. 4-10), has been derived from photo-geologic evidence, from outcrop exposures on the banks of the Bowron River, from underground workings, and from 22,000 feet of diamond drill core. The Tertiary sedimentary rocks occupy a northwest-trending lineal basin approximately 10 miles in length and 1½ miles in width and attain a thickness in excess of 2200 feet. The sequence, consisting of shale, sandstone, breccias, and coal beds, for the most part dips eastward from 20 to 60 degrees; however, because of limited drill hole information east of the underground workings the basin may be more structurally complex than indicated.

Coal Section

Coal of economic interest occurs within a stratigraphic section ranging in thickness from 60 to 200 feet. The coal measure, which maintains a dip to the east at angles varying from 20 to 60 degrees, occupies the basal 250 feet of the sedimentary sequence. Most clearly established along the western margin of the basin by underground workings and closely spaced drilling, the coal measure has been extended eastward by widely spaced drilling to cover an area 14000 feet by 5000 feet. It remains open to projection to the north, east, and south.

Within the coal-bearing section three seams have been identified on the west bank of the Bowron River. The upper seam reaches 8 feet in thickness, the middle seam 11 feet, and the lower seam 9 feet. The upper two seams have been partially explored by 1200 feet of underground workings developed from two adit entries.

The continuity of these seams over the extent of the area explored by drilling has not been established with a reasonable degree of reliability down dip from the edge of the basin. Some difficulty has been experienced by workers on the property in correlating individual seams between drill holes. Individual seams may be discontinuous and seam thicknesses appear to vary markedly, ranging from 5 to 24 feet. However, as these holes are widely spaced, little conclusive evidence regarding continuity of coal within the basin can be established until further, more systematic drilling is carried out.

Coal Reserves

The exploratory programs which have been conducted on the deposit to date have tested in a preliminary way an area some 14000 by 5000 feet within the Bowron River basin. More definitive work has been concentrated along a section of the western rim of the basin that covers an area 8000 feet along strike and 2500 feet down dip.

Coal reserve calculations were carried out by Northern Coal Mines incorporating all drill hole data. With widely-spaced drill hole information contributed by Bethlehem Copper Corp. Ltd., the total coal in place was calculated to be 81.4 million tons. This figure represents in situ coal; however, because of the

apparent lack of continuity of individual coal seams no estimate of mineable coal was made. Based upon the drilling density the above reserve figure is categorized as follows:

Proven Reserves	7.3 million tons (the Upper 8 ft. seam)
Probable Reserves	51.2 million tons
Possible Reserves	<u>22.9 million tons</u>
	81.4 million tons

There appears to be no possibility, within the area of established coal reserves, of utilizing surface mining methods. The deposit must therefore be accepted as an underground operation with the related higher mining costs and possibly lower mining recoveries.

The ultimate resource potential of the Bowron River basin remains to be determined. There is no reason to believe the coal measure will not continue for some distance northwest and southeast of the explored section of the graben structure.

The rank of the coal is classified as high volatile B Bituminous by A.S.T.M. standards. The coal has a high lustre and is hard and dense. Coal from underground workings on the property has yielded a coke button with a free-swelling index of one near the surface and three in progressively deeper workings.

Analyses of coal samples were obtained by Northern Coal (on an air dry basis) and by Bethlehem Copper Corp. Ltd. (on a dry basis).

The Northern Coal samples taken from two localities on the Upper or Main Seam graded as follows:

For: a) No. 1 ADIT AND b) No. 2 ADIT (200' FROM SURFACE)

see: BW - BOWRON RIVER 75(4)A
CONFIDENTIAL ANALYSIS FILE

The above samples were taken from the Main or Upper seam. The company also analyzed samples from underground workings on the Middle seam, (11 feet in thickness), and from the Lower seam which was presumably sampled at the surface. These samples returned the following analyses:

For: a) MIDDLE SEAM (NEAR SURFACE), b) MIDDLE SEAM (400' FROM SURFACE), AND c) LOWER SEAM

See: BW - BOWRON RIVER 75(4)A
CONFIDENTIAL ANALYSIS FILE

Bethlehem Copper Corp. Ltd. analyzed coal from four of five holes drilled. Their fifth hole located 3200 feet east of the Bowron River intersected volcanic rock. The samples returned average values as follows:

For: a) from 19 samples, and b) from 11 samples

See: BW - BOWRON RIVER 75(4)A
CONFIDENTIAL ANALYSIS FILE

The discrepancy between ash content in the Bethlehem Copper Corp. drilling which tested the deeper portion of the basin near the centre of the graben and the western, more intensely explored edge of the basin has not been explained. Conceivably, shale partings in coal zones may be more prevalent toward the basin centre and were included in the analyses.

Conclusions

The Bowron River coal deposit appears to be a promising source of coal suitable for thermal plant power generation. However, it will be necessary to employ underground mining methods in the exploitation of the deposit.

Although approximately 80 million tons have been indicated in situ by drilling and good possibilities exist to extend the deposit along strike, the continuity of seams as expressed on surface should be viewed with reservation. Mineable coal may be non-existent deeper in the basin or restricted to 50% recovery if the basin structure is complex. Otherwise, hydraulic methods might be employed to extract the coal with attendant lower costs and higher recoveries, provided that reasonable continuity can be shown to exist along seams by increased, more systematic diamond drilling.

4.6 COAL RESERVES AND RESOURCES

Coal reserves have been calculated from drill and other data in six basins in the southern interior. These are the Cariboo, Hat Creek, Nicola (Merritt), Tulameen, Princeton, and Bowron River basins. The total reserves in millions of tons available in the southern interior is as follows:

<u>Basin</u>	<u>In Situ Reserves</u>	<u>Mining Method</u>	<u>Calorific Value</u>
Cariboo	1.3	underground	6000 - 7000 Btu/lb.
Hat Creek	890	open pit	6000
Merritt	20	underground	12,000 - 13,000
Tulameen	41	open pit	7000 - 9000
Princeton	11	open pit	5000 - 6000
Bowron River	81	underground	11,000 - 12,500

On the basis of the available data it is evident that coaly accumulations in sedimentary rocks of Miocene age have no potential for commercial exploitations, except possibly for small local markets. Sufficient evidence is at hand, however, to indicate that in sedimentary "basins" of Eocene and Paleocene age offer very good potential to define additional reserves to those presently developed in the Hat Creek, Merritt, Tulameen, Princeton and Bowron River areas, providing that sufficient and systematic exploration can be funded and implemented.

Table 4-2 summarizes the potential coal resources of the southern interior. Most of these resources are inferred because of the frequently unknown extent of coal in a given basin, because of variable seam thickness indicated by drilling, and because of uncertain continuity due to the sometimes complex geology in some of these Tertiary basins.

TABLE NO. 4-2

COAL RESOURCES - SOUTHERN INTERIOR

(All figures in "millions of short tons")

Deposit	<u>RESERVES</u>	<u>RESOURCES</u> (Figures rounded off)		<u>TOTALS</u> (Figures rounded off)	
	(1) All	(2) Indicated	(3) Inferred	(1) & (2)	(1) & (2) & (3)
Cariboo	1.3	120	1,300 - 6,300	120	1,400 - 6,400
Hat Creek	890	---	1,000 - 15,000	900	2,000 - 16,000
Merritt	20	40	350 - 2,700	60	400 - 2,800
Quilchena	---	---	40 - 70	---	40 - 70
Tulameen	41	5	40 - 240	50	90 - 290
Princeton	11	855	1,900 - 3,900	900	2,700 - 4,700
Bowron River	81	40	120 - 260	120	240 - 380
Total	1044	1060	4,700 - 28,000	2150	7,000 - 31,000

4.7 CONCLUSIONS

It is evident that very large tonnages of coal suitable for thermal power plant feed occur in Tertiary rocks of the southern Interior Belt of British Columbia. Most of these tonnages occur as potentially in situ resources; that is, as coal likely to be found providing that sufficient exploration were undertaken. There are, however, over a billion tons of coal that have been defined as established reserves.

The Hat Creek deposits have the largest reserves in the region; approximately 90% of the total. These deposits can be extracted by open pit mining methods. Much lesser, but important, reserves of open pit coal have been identified at Tulameen and Princeton. Coal reserves that must be mined by underground methods exist at Merritt and Bowron River.

The Tertiary coals of the southern interior occur principally in rocks of Eocene age. One deposit at Bowron River apparently is of Paleocene age. Five basins of Eocene sedimentary rocks, perhaps remnants of what was once a more extensive basin, are known to contain coal deposits of importance. These are the Cariboo, Hat Creek, Nicola, Tulameen, and Princeton basins. It is conceivable that with comprehensive exploration both the Cariboo and Princeton basins could be found to contain coal deposits as large as those at Hat Creek. Because the Nicola and Tulameen basins have been explored more the chances of finding very large deposits comparable in magnitude to Hat Creek are somewhat lessened.

At Bowron River the graben containing the coal measure appears to be a major structure. As such it could well continue for some distance northwest and southeast, thereby offering a promising belt for coal prospecting.

The coal of the southern interior is generally low to non coking high volatile sub-bituminous with calorific values ranging from 6000 to 13,000 Btu per lb.

It is apparent that the Eocene basins of southern British Columbia are potentially major sources of surface and underground coal. Therefore they warrant more comprehensive exploration, as does the Paleocene Bowron River graben. Exploration will likely require reconnaissance drilling.